

THE  
Tea Research Institute  
OF  
Ceylon.



BULLETIN No. 13.

Annual Report for the Year  
1935.



Published by

THE TEA RESEARCH INSTITUTE OF CEYLON,  
ST. COOMBS, TALAWAKELLE.



# The Tea Research Institute of Ceylon.

## BOARD OF CONTROL

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### (A) Representing the Planters' Association of Ceylon :—

- (1) Mr. R. G. Coombe
- (2) Mr. Jas. Forbes (Jnr.) (Chairman)
- (3) Mr. J. D. Hoare

### (B) Representing the Ceylon Estates Proprietary Association :—

- (4) Mr. D. T. Richards
- (5) Major J. W. Oldfield, M.C., C.M.G., O.B.E.
- (6) Mr. I. L. Cameron

### (C) Representing the Low-Country Products' Association :—

- (7) Colonel T. G. W. Jayewardene, V.D.

### (D) Representing the Small-Holders :—

- (8) Mr. D. H. Kotalawala, M.S.C.

### (E) Ex-Officio Members :—

- (9) The Hon. the Financial Secretary
- (10) The Director of Agriculture
- (11) The Chairman, Planters' Association of Ceylon
- (12) The Chairman, Ceylon Estates Proprietary Association

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Secretary, Dr. Roland V. Norris, D.Sc., St. Coombs, Talawakelle.

# TENTH ANNUAL REPORT

OF THE

BOARD OF THE TEA RESEARCH

INSTITUTE OF CEYLON

FOR 1935.

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**Foundation:**—The Tea Research Institute of Ceylon was established by Ordinance No. 12 of 1925, dated the 27th October, 1925.

## Past Chairmen of the Institute.

| Name                                          | Date of Appointment  | Date of Resignation. |
|-----------------------------------------------|----------------------|----------------------|
| Major J. W. Oldfield,<br>C.M.G., O.B.E., M.C. | 7th January, 1926    | 24th November, 1926  |
| Mr. John Horsfall                             | 24th November, 1926  | 14th April, 1927     |
| Mr. R. G. Coombe                              | 14th April, 1927     | 9th April, 1929      |
| Major J. W. Oldfield,<br>C.M.G., O.B.E., M.C. | 9th April, 1929      | 30th September, 1929 |
| Mr. C. Huntley-Wilkinson                      | 30th September, 1929 | 28th November, 1929  |
| Mr. R. G. Coombe                              | 29th November, 1929  | 7th April, 1932      |
| Mr. G. K. Stewart                             | 7th April, 1932      | 26th November, 1932  |
| Mr. R. G. Coombe                              | 26th November, 1932  | 13th January, 1934   |
| Mr. Jas. Forbes (Jnr.)                        | 13th January, 1934   |                      |

## BOARD OF MANAGEMENT.

The Ordinance lays down the Constitution of the Board; the personnel on the 1st January, 1935 was :—

### *Ex-Officio Members.*

The Hon'ble the Financial Secretary (Hon. Mr. H. J. Huxham).

The Director of Agriculture, (Dr. W. Youngman, D.Sc., Ph.D.).

The Chairman, Planters' Association of Ceylon, (Mr. B. M. Selwyn).

The Chairman, Ceylon Estates Proprietary Association, (Mr. C. E. Hawes).



*Representatives of the Planters' Association of Ceylon.*

Mr. James Forbes (Jnr.).  
Mr. R. G. Coombe.  
Mr. J. D. Hoare.

*Representatives of the Ceylon Estates Proprietary Association.*

Major J. W. Oldfield, C.M.G., O.B.E., M.C.  
Mr. I. L. Cameron.  
Mr. D. T. Richards.

*Representative of the Low-Country Products Association.*

Col. T. G. Jayewardene, V.D.

*Representative of the Small-Holders.*

Mr. D. H. Kotalawala.

*Chairman, Tea Research Institute* :—Mr. James Forbes (Jnr.).

*Secretary, Tea Research Institute* :—Mr. A. W. L. Turner.

*Solicitors* :—Messrs. Julius & Creasy.

*Auditors* :—Messrs. Ford, Rhodes, Thornton & Co.

*Registered Office* :—The Victoria Commemoration Buildings,  
Kandy.

**Chairman, T. R. I.** :—Mr. R. G. Coombe acted as Chairman during Mr. James Forbes' visit to Java on behalf of the Institute from the 6th April to the 8th May; and Mr. R. P. Gaddum acted as Chairman during the period of Mr. James Forbes' illness, from the 26th October to the 9th November.

**Members of the Board, T. R. I.** :—Mr. R. P. Gaddum on succeeding Mr. B. M. Selwyn as Chairman of the Planters' Association of Ceylon on the 8th March, became an ex-officio member of the Board.

Mr. E. L. Fraser became an ex-officio member of the Board on succeeding Mr. C. E. Hawes as Chairman of the Ceylon Estates Proprietary Association as from the 3rd April.

The following members having retired by rotation in accordance with Section 5 (a) of Ordinance No. 12 of 1925, which limits the period of appointment to three years, were duly renominated for a further period as from the date stated against each name :—

Mr. R. G. Coombe (Nominated by the Planters' Association of Ceylon) 1-1-35.

Major J. W. Oldfield, C.M.G., O.B.E., M.C. (Nominated by the C.E.P.A.) 1-1-35.

Mr. D. H. Kotalawala (Nominated by H. E. the Governor) 1-1-35.

Col. T. G. Jayewardene, V.D. (Nominated by the L. C. P. A.) 29-9-35.

Mr. D. T. Richards was away on furlough as from the 8th May to the 13th August, and Mr. F. A. Bond was appointed to act for him during that period.

Mr. R. G. Coombe proceeded on furlough on the 15th May and Mr. A. H. Reid filled the vacancy until Mr. Coombe resumed his seat on the 10th December.

During the absence of the Hon'ble the Financial Secretary (Mr. H. J. Huxham) on furlough, Mr. C. H. Collins, the Deputy Financial Secretary acted for him.

Mr. I. L. Cameron was away on furlough from the 19th October to the 15th November, and Mr. C. E. Hawes acted for him.

Dr. W. Youngman, Director of Agriculture, retired during the course of the year and Dr. J. C. Hutson was appointed Acting Director of Agriculture.

**Secretary, T. R. I.**—Mr. A. W. L. Turner proceeded on furlough from the 20th March to the 20th November, and Mr. S. C. Bisset, the Accountant of the Planters' Association of Ceylon, acted as Secretary of the Institute during that period.

### AUDITORS.

Messrs. Ford, Rhodes, Thornton & Co. continued to be the Institute's Auditors.

### MEETINGS OF THE BOARD OF MANAGEMENT.

The Board of Management held six Meetings, all of which were held in Colombo. The attendance at meetings averaged 9.

### COMMITTEES.

The Board has power to elect non-members to serve on Committees, etc. The following were the principal Committees during 1935:—

**Experimental Committee:**—The Director, the Chairman, the Visiting Agent of St. Coombs Estate, the Superintendent of St. Coombs Estate, Messrs. R. G. Coombe, John Horsfall, D. T. Richards, R. H. Horne, I. L. Cameron, C. H. Wilkinson and the Agricultural Chemist (Convener).

This Sub-Committee held five meetings.

**Finance Sub-Committee:**—The Chairman, Tea Research Institute of Ceylon, the Chairman, Planters' Association of Ceylon, the Chairman, Ceylon Estates Proprietary Association, Mr. J. D. Hoare, and Major J. W. Oldfield.

This Sub-Committee held five meetings.

**Medical Sub-Committee:**—The Chairman, the Director, and Major J. W. Oldfield.



**Administration Sub-Committee:**—The Chairman, Major J. W. Oldfield, and Mr. I. L. Cameron.

**Sub-Committee for the Allocation of Expenditure:**—The Chairman, Messrs. R. P. Gaddum, J. C. Kelly, and J. W. Ferguson.

### **VISITING AGENT OF ST. COOMBS.**

Mr. J. W. Ferguson, the Visiting Agent of St. Coombs, proceeded on furlough on the 3rd April, and Mr. J. E. B. Baillie-Hamilton acted as Visiting Agent for the remainder of the year.

### **JUNIOR STAFF PROVIDENT FUND.**

During Mr. R. G. Coombe's absence on furlough, Mr. A. H. Reid acted for him as a Trustee of the Fund.

An application was made by the members of the Fund to be permitted to contribute up to a maximum of 10 per cent of their salaries instead of 5 per cent as laid down in the Rules, the Board's quota to remain at 5 per cent. The Board granted this application and the necessary alteration will be made in the Rules. The new rate of contribution will come into operation on the 1st January, 1936.

### **JUNIOR STAFF MEDICAL SCHEME.**

This Scheme was inaugurated on the 1st January for the purpose of granting medical assistance to the members of the Junior Staff. It was worked as an experiment for one year ending 31st December, 1935. As the Scheme proved a success, it has been decided to put it on a permanent basis.

### **WORKMEN'S COMPENSATION ORDINANCE.**

This Ordinance came into operation on the 1st August, and all members of the Subordinate Staff of the Institute have been fully covered by insurance.

### **MEMBERSHIP OF THE C. E. P. A.**

St. Coombs was elected to the Membership of the Ceylon Estates Proprietary Association, the Chairman or his nominee to have voting power.

### **ESTATE SCHOOL.**

The School on St. Coombs was provisionally registered with effect from May, and confirmation of this registration will be considered at the next inspection in May, 1936.

### **FACTORY.**

The Institute accepted the offer of (a) Messrs. Cumberbatch & Co. to supply, free of charge, 1,000 yards of "Cutched Hessian"; and of (b) Messrs. the Colombo Commercial Co., Ltd. for special treatment of the trays of one drier.

### PASSARA SUB-STATION.

The bungalow on Gonakelle Estate, Passara, occupied by the Institute's Assistant Entomologist was required by the estate for its Assistant Superintendent. The Board felt that the work on Nettle Grub should not be interrupted and sanctioned the building of accommodation for the Assistant Entomologist and the Field Assistant, and a Laboratory on Gonakelle Estate, on a site very kindly offered by Messrs. Nayabedde Tea Co. through their Agents, Messrs. George Steuart & Co.

The Board's thanks were conveyed to Messrs. George Steuart & Co., Messrs. the Nayabedde Tea Co., and Mr. G. Kent Deaker, Superintendent of Gonakelle Estate for their good offices in this connection.

### VISIT TO JAVA.

With a view to establishing a closer liaison between the Dutch Research Stations and the Institute, the Board considered that the Chairman of the Institute, Mr. James Forbes (Jnr.) and the Director, Dr. Roland V. Norris should visit Java. The Indian Tea Association were also making arrangements for Mr. P. H. Carpenter, the Chief Scientific Officer of the Tocklai Experiment Station, Assam, to visit Java, therefore Mr. Carpenter accompanied the Chairman and the Director on the trip. The Chairman and the Director who were away from Ceylon from the 5th April to the 8th May, on their return published a most interesting report entitled, "Report on a Visit to Java."

The Board recorded its thanks to the Government of the Netherlands East Indies, the Thee Expert Bureau, the Ceylon Government, the Ceylon Tea Propaganda Board and to all the institutes and gentlemen for the assistance they rendered the Chairman and the Director during their visit to Java.

### CONFERENCE OF THE T. R. I.

The Fourth Biennial Conference of the Institute, held at the Institute's Laboratories at St. Coombs Estate, Talawakelle, on the 1st and 2nd March, was well attended. A full report of the proceedings is contained in "*The Tea Quarterly*", Vol. VIII, Part 1.

### ADMINISTRATION OF THE INSTITUTE.

At the Meeting of the Board held on the 15th March, an Administration Sub-Committee consisting of the Chairman, T. R. I., Major J. W. Oldfield, and Mr. I. L. Cameron was appointed with the following terms of reference: "To review the administration work of the Institute and report whether it is desirable or possible for this to be reorganised in such a way as to leave the Director time for technical work."

The recommendations of this Committee were still under consideration at the end of the year.



**Registered Office:**—The Registered Office of the Institute will continue to be in the Victoria Commemoration Buildings, Kandy, in compliance with Section 4 of Ordinance No. 12 of 1925, even though the Kandy office be transferred to St. Coombs.

### PUBLICATIONS.

**“The Tea Quarterly”:**—During the course of the year it was decided that articles from non-scientific men might be published in *The Tea Quarterly* but that the publication of such articles did not mean that the Institute necessarily endorsed the views expressed by these contributors.

Advertising space is available in *The Tea Quarterly* and applications in this connection should be made to the Director, Tea Research Institute of Ceylon, St. Coombs Estate, Talawakelle.

The publications of the Institute will be sent free of charge to all Proprietors, Directors, Superintendents and Assistant Superintendents of Ceylon Tea Estates of over 10 acres in extent, and to London and Colombo Agency Firms dealing in Tea, if they register their names and addresses with the Secretary, Tea Research Institute of Ceylon, St. Coombs Estate, Talawakelle.

Other persons too can obtain the publications of the Institute on payment to the Secretary, T. R. I., of a subscription of Rs. 15/- per annum if resident in Ceylon or India, and £1-5-0 if resident elsewhere. In the case of Indian cheques four annas should be added to cover commission.

Single numbers of *The Tea Quarterly* and Bulletins can be obtained at the rate of Rs. 2.50 or 4 shillings per copy.

During the year the Institute issued “The Report on a Visit to Java” by Mr. James Forbes (Jnr.) and Dr. Roland V. Norris, Bulletin No. 12 and *The Tea Quarterly* Vol. VIII, Parts 1-4.

The undermentioned publications are out of print:—

Bulletins Nos. 2, 3 and 5.

|                      |           |                         |
|----------------------|-----------|-------------------------|
| <i>Tea Quarterly</i> | Volume I, | Parts 1 to 4.           |
| „                    | „         | „ II, Parts 1, 2 and 3. |
| „                    | „         | „ IV, Parts 1 & 2.      |
| „                    | „         | „ V, Part 1.            |

### ST. COOMBS. ESTATE

**Visiting Agent:**—Mr. J. E. B. Baillie-Hamilton (Acting for Mr. J. W. Ferguson).

**Superintendent:**—Mr. John A. Rogers.

A comparison between St. Coombs prices and the Colombo market average for high grown teas is shewn in the graph on page 10.



A copy of Mr. Baillie-Hamilton's review on the work done on St. Coombs during the year is attached.

### **ACKNOWLEDGMENTS.**

The thanks of the Institute are due to the Ceylon Chamber of Commerce, Colombo, for the loan of their Board Room, for meetings of the Institute held in Colombo.

The closest co-operation continues to be maintained with the various Associations interested in the Tea industry and the Ceylon Association in London.

### **FINANCE.**

The Audited Statement of Accounts and Balance Sheet for the year 1935 are included at the end of this Report.

A. W. L. TURNER,  
*Secretary.*

# REPORT

ON

## ST. COOMBS ESTATE

FOR 1935.

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**Superintendent:**—Mr. John A. Rogers.

### ACREAGE.

|                                |     | A.         | R.P.        |
|--------------------------------|-----|------------|-------------|
| Tea in full bearing            | ... | 226        | 0 11        |
| New Clearings                  | ... | 38         | 0 35        |
| Nurseries                      | ... | 3          | 0 25        |
| Fuel Clearing                  | ... | 14         | 0 00        |
| Reserve available for planting |     | 65         | 3 19        |
| Building sites                 | ... | 24         | 0 12        |
| Waste, Swamp, etc.             | ... | 43         | 1 37        |
|                                |     | <u>414</u> | <u>3 19</u> |

**Climate:**—The season started with a very dry January and February — this following an exceptionally dry November and December in 1934. Rain fell in March, but April and May were again dry. The latter part of the season was normal for Dimbula and actually the rainfall for the year was 84.69 inches on 214 days compared to 75.93 inches on 218 wet days in 1934.

**Crop:**—The crop secured in 1935 was 138,182 lbs.

,, ,, ,, in 1934 ,, 134,285 ,,

Increase of 3,897 ,,

The increase on the estimate of 135,000 lbs. was therefore 3,182 lbs.

Yield per acre to 31st December, 1935 on 246 acres in plucking 562 lbs. per acre.

Yield per acre to 31st December, 1934 on 226 acres in plucking 594 lbs. per acre.

Yield per acre to 31st December, 1933 on 169 acres in plucking 781 lbs. per acre.

Drop in yield per acre is due to bringing in young tea areas.



**Sales:**—Nett average for 1935 comes to 77 cents (76·93 exactly) per lb., compared to 66·12 cents in 1934 and 68·53 cents in 1933. This shows a profit of 25 cents per lb.

**Cost of Production:—**

Cost of production for 1935 is 51·30 cents per lb. Estimated 57·56.

Cost of production for 1934 was 51·26 cents per lb. Estimated 55·20.

There were 11,746 lbs. tea manufactured for Carlabek @ 15 cents., which helped to reduce cost per lb. by over 1 cent.

**Buildings:**—One single set of 10 room lines with 4 latrine compartments has been erected this season.

**Clearings:**—Block B  $7\frac{3}{4}$  acres of 1931 clearing was pruned in September to 12 inches. The 1932 clearing  $9\frac{1}{2}$  acres was pruned in September to 12 in., 8 inches and 4 inches as required by individual bushes.

The young tea areas have now been divided up into fields as from 1st January, 1936, to enable their more convenient working.

The following supplying was done:—

In 1931 clearing 2,262 tea supplies and 485 grevilleas.

In 1932 clearing 781 tea supplies and 150 grevilleas.

All the clearings have come on very well indeed and are looking in good heart and free from disease.

**Cultivation:**—Manuring has been carried on as in the previous season inorganic manures being used.

As the tea is all looking well, and as there is evidently no falling-off in the quality of made tea, it seems that inorganic manure is a suitable manure to apply to tea.

**Nurseries:**—Six maunds Kirimetiya tea seed were put down in the nurseries and started well, but are rather patchy at present.

**Green Manure:**—A lot has been done, but has not been very successful and must just be pegged away with till it improves.

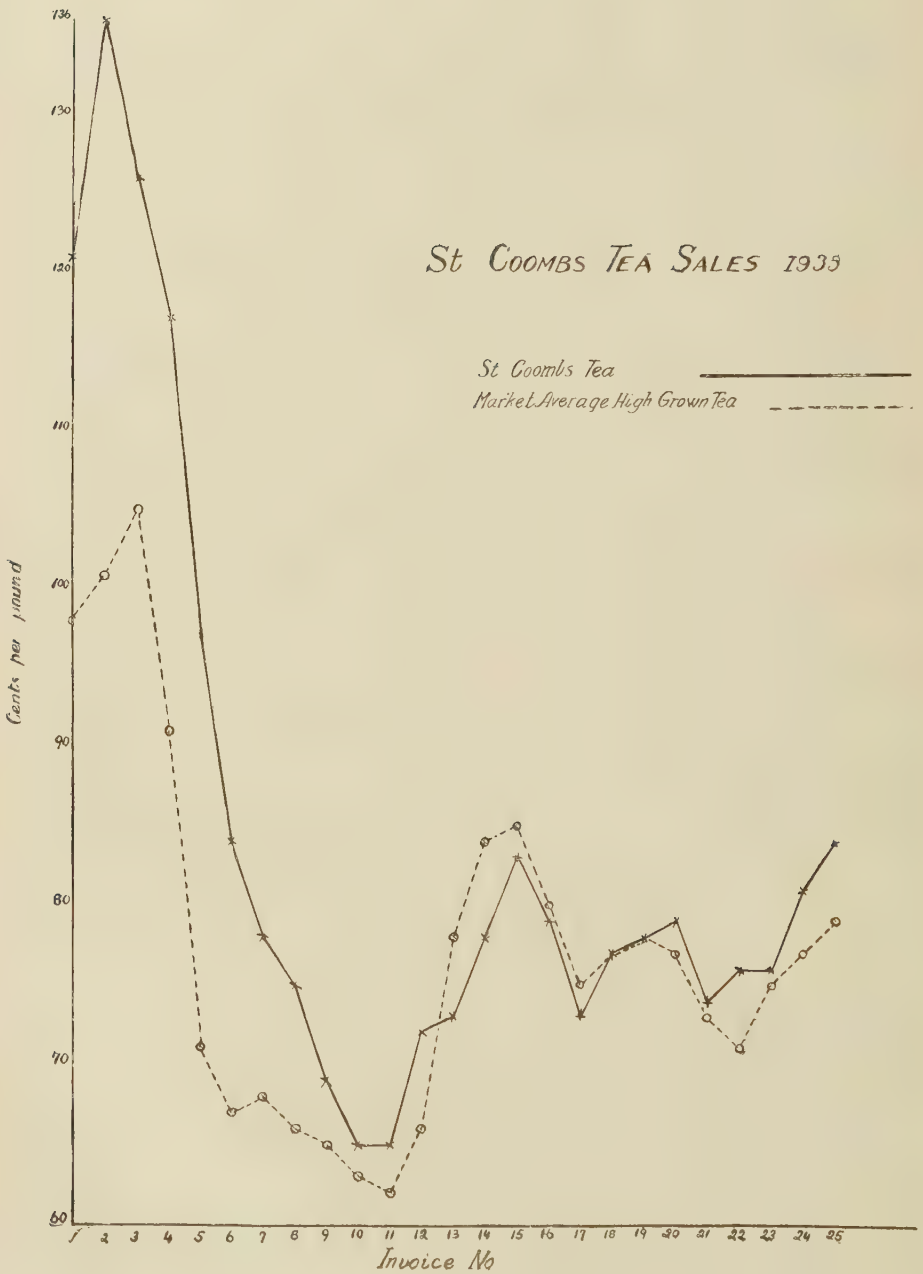
**General:**—This must I think be considered a satisfactory year for the estate. It is looking better than I remember seeing it and the profits from the producing area will show a useful sum per acre.

(Sgd.) J. E. B. BAILLIE-HAMILTON.

# St COOMBS TEA SALES 1935

St Coombs Tea

Market Average High Grown Tea





**Meteorological Observations 1935.**  
**St. Coombs.**

| Month     | Temperature   |               |                  |                  | Mean<br>Relative<br>Hum-<br>idity | Rainfall<br>Inches | No. of<br>Rainy<br>days | Hours of<br>Sunshine |
|-----------|---------------|---------------|------------------|------------------|-----------------------------------|--------------------|-------------------------|----------------------|
|           | Mean.<br>Max. | Mean.<br>Min. | Adopted<br>Mean. | Mean on<br>Grass |                                   |                    |                         |                      |
|           |               |               |                  |                  |                                   |                    |                         | hrs. mts.            |
| January   | 73·8          | 56·5          | 65·4             | 51·0             | 70                                | 2·84               | 11                      | 195·03               |
| February  | 75·4          | 53·5          | 64·4             | 45·0             | 64                                | 1·03               | 6                       | 219·20               |
| March     | 77·3          | 55·4          | 66·4             | 49·4             | 72                                | 6·21               | 15                      | 229·16               |
| April     | 77·8          | 56·2          | 67·0             | 50·7             | 76                                | 4·94               | 10                      | 241·05               |
| May       | 75·8          | 59·3          | 67·6             | 55·9             | 80                                | 3·87               | 20                      | 175·48               |
| June      | 71·9          | 60·6          | 66·2             | 59·7             | 84                                | 9·10               | 28                      | 92·08                |
| July      | 70·3          | 58·6          | 64·4             | 56·8             | 84                                | 11·68              | 23                      | 100·22               |
| August    | 70·2          | 57·7          | 64·0             | 56·8             | 86                                | 10·24              | 28                      | 100·29               |
| September | 71·8          | 57·9          | 64·8             | 56·5             | 84                                | 5·30               | 19                      | 181·22               |
| October   | 73·0          | 57·5          | 65·2             | 55·8             | 84                                | 11·16              | 24                      | 157·15               |
| November  | 74·0          | 56·9          | 65·4             | 53·7             | 81                                | 11·32              | 18                      | 179·56               |
| December  | 73·3          | 56·4          | 64·8             | 53·2             | 80                                | 7·86               | 20                      | 144·21               |
| Annual    | 73·7          | 57·2          | 65·5             | 53·7             | 79                                | 85·55              | 222                     | 2016·25              |
|           | Means         |               |                  |                  |                                   | Total              |                         |                      |

# REPORT

OF

## THE DIRECTOR,

### TEA RESEARCH INSTITUTE OF CEYLON

FOR 1935.

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In the Report for 1934 reference was made to the diminution in the Institute's receipts brought about by restriction of exports and the poor prices then prevailing in the tea market.

The decision of the International Tea Committee to continue the rate of restriction at  $17\frac{1}{2}$  per cent. for 1935-36 resulted in a further fall in the yield from the cess which realised Rs. 298,492 as compared with Rs. 304,940 in 1934. The yield would have been still lower but for unusually high exports of tea in October, November and December due to the decision to limit the validity of coupons.

Fortunately the fall in income from the above cause was more than offset by an improvement in tea prices which resulted in the profit on the Estate working account rising from Rs. 18,113 in 1934 to Rs. 36,676 in 1935. In consequence, the gross receipts for 1935 amounted to Rs. 338,351 compared with Rs. 323,935 in 1934.

Expenditure on Research Revenue Account was Rs. 198,929 and, after making provision of Rs. 34,123 for depreciation and machinery reserves, and meeting interest charges on the Government Loan amounting to Rs. 51,984, there was a surplus of Rs. 53,312.

On Capital Account Rs 25,855 was repaid against the loan which now stands at Rs. 847,006, while estate capital expenditure amounted to Rs. 16,515, the chief items being new lines and maintenance of young clearings.

Research capital expenditure was Rs. 50,508, this including Rs. 15,578 spent on the new Sub-Station at Passara, Rs. 11,627 on the water supply at St. Coombs, Rs. 7,336 on experimental machinery, and Rs. 4,269 for the replacement of the car.

Capital expenditure in the immediate future is likely to be limited chiefly to new and additional machinery for St. Coombs factory and for opening up a further area of tea. For the first of these objects, however, considerable sums may be required if the factory is to be kept fully up-to-date, which it must be if the Institute is to exercise its proper function in regard to tea manufacture. The building up of an adequate reserve for this purpose is, therefore, a matter of major importance.

**Co-operation in Tea Research:**—Implementing the decision taken to promote greater contact between the St. Coombs' scientific staff and the staffs of other tea research laboratories, the Director, in company with the Chairman of the Board, paid a visit to Java in April last, spending about three weeks touring through the main tea districts of the Island.

It was fortunately possible for arrangements to be made for this visit to coincide with a visit by Mr. P. H. Carpenter, the Chief Scientific Officer of the Tocklai Experimental Station, Assam, and the tour was throughout made in the company of that officer. This was the first time the Directors of the three tea experimental stations at Buitenzorg, Tocklai and St. Coombs had been able to meet together, and the opportunity was naturally taken for a full discussion of the experimental work in progress in each station.

Such meetings serve a most useful purpose, providing as they do the means for co-ordinating the work in progress, and it is greatly to be hoped that they will become a regular arrangement. At the same time it is highly desirable that other members of the staff should have similar opportunities of seeing the work in progress in other countries, and of meeting those engaged in similar problems. A beginning has been made in this direction, and we were glad to welcome to St. Coombs in July Mr. H. R. Cooper, the Agricultural Chemist at Tocklai, while in November Dr. Eden paid a return visit to Tocklai and toured through some of the tea districts of North-East India. Arrangements are also in hand for a visit to South India by Dr. Tubbs and a very cordial invitation has been issued to the Buitenzorg staff to visit St. Coombs.

In regard to the visit to Java, the deputation received the utmost consideration from all the authorities concerned, and we were thus enabled to establish contact with persons who were thoroughly representative of official, commercial and technical interests.

Perhaps one of the most striking features of the tour was the fact that, in spite of the severity with which all the planting industries in the Netherlands East Indies have been hit by the economic conditions prevailing in the past few years, no expense is at present being spared to rationalise the tea industry and to replace old out-of-date buildings and plant. The fact that funds are available and so freely used is a tribute to the conservative financial policy pursued in better times and to the courage and enterprise of those now directing the industry.



Conditions vary considerably between Java and Ceylon and, in consequence, the agricultural practices favoured by Dutch planters are not necessarily those best adapted to Ceylon. But there can be no question that Ceylon has much to learn in regard to methods of soil conservation. It is, to say the least, disappointing to know that the large majority of estates in Ceylon still employ scrapers, and to realise that the importance of adequate soil protection is very imperfectly appreciated.

In regard to tea manufacture, attention to detail and close control over every process are the salient features of a modern Dutch factory. Such control is facilitated by the improved design of much of their machinery, and also by the fact that, as a result of their larger units, highly trained factory supervision is usually available.

Great attention to grading is given in all Java factories and this again is a point which might well receive more consideration in Ceylon.

It may be apposite to note here that a large proportion of the assistants on Java estates receive some agricultural or engineering training before leaving Holland. They are thus in a position to take advantage of the latitude allowed them in the technical working of their estates, and their eagerness to test out new methods, both in the field and the factory, was very evident.

In regard to Tea Research, it was of interest to note that the Thee Proefstation West Java was working on generally similar lines to the Ceylon Institute and that the results obtained were in close accord.

Reference must be made to the interesting work on budgrafting of tea which is being utilised in Java for the production of high-yielding and more uniform stands of tea. Details of this, and a general description of the tour, will be found in the full report on the visit which has already been published. It only remains to place on record our indebtedness to all those in Java whose co-operation and willing assistance contributed so much to the interest of the visit.

**St. Coombs Estate:**—The rainfall was again below average but the distribution was, on the whole, favourable, and the crop obtained, 138,182 lbs. was slightly above that estimated. Prices were distinctly better than in 1934, particularly during the earlier part of the year, and the nett average realised in the Colombo market was 76·93 cents, yielding a profit of 25 cents per lb.

Except for a brief period in the middle of the year, during the Uva season, St. Coombs teas, as will be seen from the graph given earlier in this report, sold at prices considerably above the high-grown average.

**Buildings:**—Work was commenced on the buildings for the Institute's Sub-Station on Gonakelle Estate, Passara, and these were practically completed by the end of the year. The new buildings comprise a small laboratory with insectory and storé room, and quarters for the Assistant Entomologist. The thanks of the Institute are due to the Nayabedde Tea Company, Ltd., Messrs. George Steuart & Co., Colombo, and the Superintendent, Gonakelle Estate, for the facilities afforded.

On the estate one ten-room block of lines was constructed.

**Water Supply:**—Owing to the unprotected nature of the sources and the resulting unsatisfactory quality of the supply, it became necessary during the year to instal a Jewell filter and to reorganise the distribution system.

The supply was also somewhat precarious in regard to quantity towards the end of the dry weather and severe restrictions had to be imposed for a short period.

**Publications:**—In addition to *The Tea Quarterly*, one Bulletin and a special *Report on a Visit to Java* by the Chairman and Director of the Institute, were issued during the year.

Several articles from contributors other than members of the staff were published in *The Tea Quarterly* and the Editor will always be glad to receive such papers. It is to be understood, however, that publication does not imply that the Institute necessarily endorses the views expressed.

The demand for the Institute's publications continues to increase and a sum of Rs. 3,893 was received as subscriptions from those not entitled to a free issue. Rs. 2,327 was realised from advertisements, with the result that the publications were more than self-supporting.

**Staff:**—No changes occurred in the Senior Staff during the year.

The Director was away in Java from April 5th to May 8th and on sick leave from October 29th to December 2nd. During both these periods Dr. Gadd acted as Director of the Institute in addition to his own duties.

Dr. Eden was absent from the 30th October to the 8th December when he paid a visit to the Tocklai Experimental Station and toured through some of the chief tea areas of North-East India. A report on this visit will be issued in due course.

Mr. C. B. Redman King, the Institute's Entomologist, resumed duty on the 28th January on his return from home leave.

Dr. F. R. Tubbs returned from furlough on the 10th August. During his absence his duties were divided between the Mycologist and the Agricultural Chemist.

Mr. J. A. Rogers, the Superintendent, St. Coombs Estate, returned from home leave on the 18th January, relieving the Acting Superintendent, Mr. E. J. K. Garthwaite.

Amongst the Junior Staff, Mr. C. A. de Silva resigned his post on the 31st August to take up an appointment at the Rubber Research Scheme, and Dr. J. G. Shrikhande, Ph.D., M.Sc., A.I.C., was elected to fill the vacancy.

In view of the success of the small-holdings work in the Gampola area, the Board approved of the appointment of an additional Small-Holdings Officer. Mr. E. F. Kannangara was selected for this post and is now stationed at Baddegama in the Southern Province.

It is gratifying to report that during the year Dr. T. Eden was awarded the degree of Doctor of Science in the University of Manchester and Dr. F. R. Tubbs the degree of Doctor of Philosophy in the University of London.

**Conference :—**The Fourth Conference of the Tea Research Institute was held at St. Coombs on the 1st and 2nd March and was attended by nearly 200 visitors. On the first day a review of the Institute's work was given by the Director and discussions were held on Drought Conditions in Relation to Tea Culture and on Tea Manufacture. On the second day visitors were shown round the laboratories and factory when the staff explained the different items of work in progress.

A full report of the Papers and Discussions will be found in *The Tea Quarterly*, 1935, Vol. VIII, Part I.

As the name implies, the Conference is intended for an exchange of ideas between the staff and the visitors and not merely for the reading of papers by the staff. The purpose of such meetings will not be fully achieved until there is a greater readiness shown on the part of planters, and particularly the younger men, to take part in the discussions. The reluctance of the latter group to speak on such occasions raises the question, which has in fact been mooted in several quarters, whether a separate Conference should not be held for Assistant Superintendents.

**Advisory Work :—**Rather more than two thousand enquiries were received from estates and agency firms, this figure being some four hundred in excess of the previous year. Excluding visits to small-holdings, 150 visits were paid to estates by members of the staff, this number being practically identical with the figure for 1934.

**Lectures :—**There was a wide-spread demand for lectures by the staff and twenty addresses were given to District Planters' Associations, those visited comprising the Dimbulu, Dickoya, Kandy, Uva, Nuwara Eliya, Sabaragamuwa, Matale, Rangala and Urugalla, Madulkelle, Kalutara, Kotmale and Dolosbage, and Pussellawa Associations.



Such visits serve a very useful purpose in promoting contact between the staff and the planting community.

In addition, addresses were given before the Ceylon Estates Proprietary Association and the Standing Committee of Agriculture of the Planters' Association of Ceylon, while, outside Ceylon, Dr. Tubbs gave a review of the work of his section to the Ceylon Association in London and Dr. Eden, during his tour in Assam, addressed the Darjeeling Planters' Association and the Hailakande Circle of the Surma Valley Branch of the Indian Tea Association.

**Diseases and Pests:**—The effect of the drought in 1934 and the early part of 1935 was seen later in the year in numerous cases of dieback amongst shade trees, particularly *Grevillea*, the dieback being frequently associated with *gummosis*.

Examination of numerous specimens by the Mycologist failed to indicate the presence of any causative organism and the trouble is probably to be assigned to the production of weak and abnormal shoots as a result of the drought.

Amongst fungus diseases, root diseases and *Poria* in particular, were the most prevalent. For the elimination of this disease it is clear that more drastic measures are necessary than are usually employed on estates. Elimination of only obviously diseased bushes, diagnosed from the above-ground symptoms, and isolation of infected areas by trenches are quite ineffective as control measures. Attention is therefore invited to Dr. Gadd's report in which the treatment now recommended is detailed. Such treatment will necessarily be more costly in the first place than the methods now commonly used, but should prove economical in the long run, offering as it does some prospect of definitely checking the spread of the disease.

Speculation has often been aroused as to whether wood rotting fungi gain an entrance into the frames of tea bushes through the galleries made by the shot-hole borer. The Mycologist has therefore made an investigation of the fungi occurring in such galleries. So far only two species have been isolated and inoculation experiments have indicated that neither of these will rot wood unaided. So far, therefore, the evidence is against wood rot arising in this manner, though it cannot yet be definitely excluded that the fungi in question may prepare the way for more destructive species.

In the report for 1929 the Mycologist referred to a dieback of tea branches during the first year from pruning. Further attacks of this disease in several districts have enabled a fuller investigation to be made as to the cause. This has clearly been shown to be the fungus *Leptothyrium theae*, Petch. Unfortunately it is now established that the fungus may extend its activities to the main stem, resulting in the death of the bush. The disease

is therefore of much greater importance than was first considered likely. A detailed description, together with recommendations as to the protective measures required in case of attack, will be found in Dr. Gadd's report.

New diseases of green manure crops, attacking *Crotalaria usarmoensis*, *Gliricidia maculata* and *Clitoria cajanifolia* respectively, have also to be recorded, while *Rosellinia* has been found on the roots of *Tephrosia*.

Judging from the number of consignments of specimens sent in for identification and report, 238 as against 359 in 1934, insect pests in 1935 were less prevalent than usual.

Tortrix, in spite of generally favourable climatic conditions, was not much in evidence.

A final trial was carried out at St. Coombs of the liberation of *Trichogramma* parasites as a control measure against Tortrix. This, however, was no more successful than previous trials and it is clear that no effective control can be obtained in this way. The short life cycle of *Trichogramma* is an obstacle since the parasite cannot span the gap existing between oviposition in succeeding generations. Further work with this parasite has therefore been abandoned and the breeding rooms have been converted into an insectory.

The opportunity was taken while the Director was in Java to obtain further information about other parasites of Tortrix which occurs in Java but causes little damage there. Through the co-operation of the Department of Plant Diseases at Buitenzorg a consignment of parasites was later obtained, this including six species new to Ceylon. These are now under examination.

Meantime the results of substituting more intensive collection of tortrix egg masses, confined to certain selected periods, for the present method of collecting throughout the year, are being watched. The marked periodicity of tortrix attacks offers hope that this may lead to greater control at a lower cost.

Nettle Grub attacks showed a marked falling-off, both in number and severity, the figures being the lowest for many years. In consequence spraying was not carried out to any great extent. A more efficient type of sprayer was designed by the Entomologist and has given very promising results. This can be seen at the Passara Sub-Station.

An ovicide consisting of kerosene and liquid fuel, and applied with a small hand atomiser, has been very successful against the eggs of *Natada nararia* and *Narosa conspersa*. It is not, however, always easy to find the eggs.

Reference was made in last year's Report to damage caused by the caterpillar of *Prodeniya litura*. Further attacks have been reported from time to time and lend confirmation to the view that the natural food of this pest is *Oxalis*. Fortunately in regard to tea, the caterpillar seems to prefer old and coarse leaf and only attacks that when its natural food supply is no longer available.

The completion of the new buildings at the Passara Sub-Station will much increase the facilities for work and a study of shot-hole borer will now be taken up. Reports from many districts indicate that this pest is causing more and more damage. Restricted manurial programmes and lack of cultivation in the past few years are no doubt partly responsible for this.

**Agricultural Chemistry:**—As already mentioned, Dr. Eden was on tour in North-East India during November during which time he visited some of the chief tea districts of Assam and the Tocklai Experimental Station. A report on this visit will shortly be issued. The thanks of the Institute are due to the Indian Tea Association and to the Chief Scientific Officer and staff of the Tocklai laboratory for the facilities afforded.

In this section the question of composts was much to the fore during the year. The subject has been frequently referred to in the Institute's publications, but, in view of certain misunderstandings which appear to persist, it is desirable again to summarise the view held by the Institute.

There is no dispute as to the soundness of the Indore method of compost manufacture. The chief point at issue is as to whether compost is an economical proposition on the average Ceylon estate. In contrast to the conditions prevailing in Travancore where most estates can readily obtain close at hand large supplies of waste material, and can make compost at a relatively lost cost — though not at such a low figure as is often assumed — most Ceylon estates have no such facilities and the cost of production is considerably higher. Furthermore, in the majority of cases in Ceylon some two-thirds of the material used for composting has consisted of green manures and prunings obtained from the tea. The amount of *fresh* material contributed by the compost in such circumstances is therefore small and the true cost of this extremely high. Unless, therefore, it can be shown that the use of composts confers some special benefit, or that green manure and shade loppings when composted are superior in action to the same material used in the ordinary way, it appears probable that relatively few Ceylon estates will find composting an economic proposition.

Whether or not composts can confer the benefits sometimes claimed for them is a matter which experimentation alone can satisfactorily settle, and trials designed for this purpose have already been initiated.



The manurial experiments to test the effect of nitrogen and potash in varying doses have been continued and the commencement of a second pruning cycle at St. Coombs has been utilised to enlarge the experiments so as to include phosphatic manures in the survey. The experiments are also being replicated in a modified form at Passara.

Full details will be found in Dr. Eden's report, and it is only necessary to say that in regard to nitrogen and potash the results of the past twelve months again confirm the findings of previous years.

It is interesting to note that the response to nitrogenous manuring in the first year of each pruning cycle at St. Coombs, as also in the first year of the Passara experiment, has been relatively low, a finding which raises the question whether the bush for some time after pruning is able fully to utilise the manures supplied. The question is an important one in relation to the use of pruning mixtures and will receive further investigation.

Leaf from the St. Coombs manurial plots has been regularly manufactured and reports obtained on these samples from Colombo and London tasters. The results obtained strongly suggest that, at any rate, within the manurial levels of these experiments, manures have little or no effect on the quality of the made tea. Similar findings have been obtained in North-East India.

**Plant Physiology:**—The Plant Physiologist was on furlough for the first eight months of the year and the work of the section was therefore limited to the continuation of experiments in progress.

It has long been evident that in any field of tea there is a very wide variation in the yields of individual bushes, and that quite an appreciable number of bushes are really entirely uneconomical. Figures illustrating this point will be found in Dr. Tubbs' report and indicate the necessity for greater care in the selection of planting material. This point has been very fully realised in Java where, in the budgrafting experiments to which reference has already been made, budding material is only taken from bushes which have been found to give three times the average yield of the field.

The results to date of the pruning experiments at St. Coombs, Peradeniya and Galatura will shortly be published in full. The work at Peradeniya will be discontinued at the end of the present pruning cycle.

**Tea Manufacture and Biochemistry:**—For several months the time of the Biochemical section was almost entirely taken up in an important analytical enquiry undertaken at the request of the Ceylon Association in London. This naturally interfered materially with the ordinary investigations of the section. The work was completed and a report sent to London and the Ceylon Estates Proprietary Association.

In the last Annual Report reference was made to work on the keeping qualities of tea with special reference to moisture content. Further investigations on this question have shown that tea very readily takes up *or loses* moisture according to the conditions under which it is stored. The importance of this is that in the case of badly packed tea, the moisture content of the tea when examined in London may bear no relation to the moisture content of the same tea during parts of the voyage, *e.g.*, while passing through the Red Sea. Hence the difficulty in many cases of deciding how deterioration has taken place.

This emphasises the necessity for packing tea in really moisture proof containers. The Institute has had under examination during the past year a number of alternative tea chest linings. Of those so far examined, Pliofilm, a material which has a rubber basis and somewhat resembles Cellophane in appearance, seems much the most promising. Tea stored in chests lined with this material under conditions of very high humidity have shown no increase in moisture content. At present there is some difficulty in obtaining supplies of Pliofilm outside America where it is made, but the Institute is in correspondence with the makers and it is hoped that further investigations will be possible in the near future.

An examination has been made of various types of withering materials, the feature common to most of these being a more open weave as compared with ordinary jute hessian. Little difference has been observed in the rate of wither with these materials, nor has the quality of the resulting tea varied in any consistent way. As there are considerable doubts as to the durability of such wide-mesh materials, there seems at present little advantage to be gained by substituting them for ordinary hessian.

Towards the close of the year considerable alterations were made to the Institute's small scale rollers and this enabled a definite study of rolling conditions to be commenced. Details will be found in Mr. Lamb's report and also in *The Tea Quarterly*, 1935, Vol. VIII, Part IV.

Preliminary work was also carried out in regard to the cost of firing with different types of fuel. So far the results are all in favour of wood.

As in previous years, by far the greatest proportion of the enquiries received in regard to manufacture have concerned firing. The subject was referred to in some detail at the last Conference, and though there was in some quarters a tendency to object to time being spent in a simple explanation of the construction and working principles of tea driers, it is clear there was every justification<sup>3</sup> for such a course, since it is obvious that, in a large proportion of estates, firing is the operation which presents most difficulty.

The Institute has long been hampered by the lack of a small scale drier on which firing experiments of a precise nature could be carried out.

It has at last been possible to design a machine which should meet our requirements and it is hoped the construction of this will shortly be put in hand.

One of the commercial driers is also to be replaced by a more modern type of machine.

Manufacture of leaf from the experimental plots was carried out throughout the year by the Biochemist and occupied 98 manufacturing days.

**Small-Holdings:**—In view of the success attending the work of the Small-Holdings' Officer stationed at Gampola, a further officer was appointed in March and stationed at Baddegama in the Southern Province. A very successful competition was held for small-holders in the Uda-Palata area, prizes and certificates being awarded to those holders who had done most to improve the conditions of their plots. Similar competitions will be organised in other areas in co-operation with Village Committees.

In many districts the small-holders were badly hit by the drought and malaria epidemic. The money realised by the sale of coupons did much to mitigate their difficulties, though the diversion of funds for this purpose necessarily led to less being spent in maintaining their holdings.

The Small-Holdings' Officer, Gampola, was seconded for malaria relief work during the months of January, February and July.

**General:**—The Director is a member of the Board of Agriculture and attended the meetings of that body. He was also present by invitation at most of the meetings of the General Committee of the Planters' Association of Ceylon.

Professor F. L. Engledow, C.M.G., Professor of Agriculture in the University of Cambridge, who was on his way to Tocklai to advise on the working of that experimental station, paid an unofficial visit to St. Coombs. During his stay of a week the opportunity was taken to discuss with him the chief problems with which the Institute is dealing.

**Acknowledgments:**—Our thanks are due to the Director of Agriculture and his staff for their co-operation in the Peradeniya experiments; to the Nayabedde Tea Co., Ltd., Messrs. Geo. Steuart & Co., and the Superintendent of Gonakelle Estate for the facilities afforded on that estate; and to the Amalgamated Tea Estates Co., Ltd., Messrs. James Finlay & Co., Ltd., and Mr. J. D. Hoare of Galatura for similar facilities on Galatura Estate.

Messrs. James Finlay & Co., Ltd., and Mr. J. T. Young have also co-operated in the compost experiments in progress on Wikiliya Estate.



We are particularly indebted to the following Colombo and London firms and their tasters who have assisted us by reporting on experimental tea samples and in other ways : —Messrs. Forbes & Walker, James Finlay & Co., Ltd., George Steuart & Co., E. John & Co., Whittall & Co., Lee, Hedges & Co., Ltd., Lipton, Ltd., Heath & Co., the Colombo Commercial Co., Ltd., Brooke Bond (Ceylon) Ltd., Henderson & Co., Harrisons & Crosfield, Ltd., Carson & Co., Ltd., Mackwoods, Ltd., Leechman & Co., Darley, Butler & Co., Bartleet & Co., Sommerville & Co., Ltd., Wilson, Smithett & Co., and George White & Co.

Particular thanks are due to Mr. R. H. Horne for the assistance he has given in regard to experimental samples.

Messrs. Cumberbatch & Co. kindly placed at our disposal a considerable quantity of withering cloth for test.

Mr. F. J. Whitehead and Mr. J. W. Ferguson have, as always, given us invaluable help and advice, and it is a pleasure to acknowledge the co-operation and hospitality so freely accorded by planters in every district to members of the staff.

The Reports of the Scientific Staff are appended.

ROLAND V. NORRIS,

*Director.*

# REPORT

OF

## THE MYCOLOGIST

FOR 1935

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**Staff:**—In addition to his own duties the Mycologist carried out part of the duties of the Plant Physiologist during the latter's absence on leave till August 10th. and those of the Director during April and November.

**Advisory:**—345 letters were received and 312 despatched. 134 consignments of plants were received for examination and report. Of these 101 were tea; the remainder consisted of *Acacia*, *Casuarina*, *Clitoria*, *Crotalaria*, *Dadap*, *Gliricidia*, *Grevillea*, *Lupin* and *Tephrosia*. Of the tea specimens 49 were diseases of the root, 17 of the branch, 25 of the leaf and 10 were miscellaneous.

Visits to 18 estates were made for investigational and advisory purposes in the Agrapatana, Balangoda, Dolosbage, Dickoya, Hewaheta, Kandapola, Maskeliya, Nuwara Eliya, Uva and Welimada districts.

**Drought:**—The drought of 1934 carried on into the early part of 1935, but it was not till the early months of that year that the shade trees, particularly *Grevilleas*, began to show its effect. It is well known that in many trees, drought injury does not become evident during the period of low moisture, but the effect is delayed until the next wet season when weak shoots may be formed and twigs and branches die back. During this year dieback of *Grevilleas* was prevalent, particularly in Uva. The dieback was usually accompanied by Gummosis, *i.e.*, an extrusion of gum from the bark. A. gummosis of *Acacias* too was reported from Uva.

Microscopic examination of the cortical tissues adjacent to young internal gum pockets of *Grevillea* and *Acacia* failed to reveal the presence of any micro-organism. Isolation experiments in which similar tissues were used gave no more satisfactory results. There is thus no evidence that an organism is associated with the conditions. These tests confirm those made earlier.

Gummosis is of course not always the result of drought as it is a common condition in some districts. Where gummosis of *Grevilleas* and *Acacias* occur it is frequently the result of unsuitable climatic conditions or elevation. Its increased incidence in Uva accompanied by dieback of the stems during the year under review was probably a result of the preceding drought.

It was also noticed on some estates where the tea had been severely affected by drought that the new growth on recovery was not normal. The new shoots and leaves were dwarfed at first, but later, normal growth was obtained.

**Poria Root Disease:**—The disease caused by *Poria hypolateritia* continues to be the most prevalent of the root diseases of tea. It is a relic from the jungle, and undoubtedly the largest patches on many estates were first infected when the fields were originally planted with tea. Yet deaths still continue to occur on the perimeters of these patches. Evidently the procedure commonly adopted in the past, viz., removal of dead or obviously dying bushes, and the construction of isolation trenches, does not effectively control the disease, and if the fungus is to be eradicated from tea estates more drastic methods will have to be employed. The first step towards eradication is the removal of every bush which bears the fungus on its roots even though the bush appears perfectly healthy above ground. This entails the examination of the root system of every bush on the perimeter of an infected area, an operation which as yet is carried out on very few estates.

The study of this disease in the field has been continued during the year at St. Coombs. Twenty-two new patches have been located during the year, the total now being 95. These patches are not new in the sense that they are recent infections as the presence of young plants or vacancies indicate that deaths from disease have occurred there previously. The patches are new in that no death has been observed since 1933 when this division took over the work. Allowing that the size of a patch affords a measure of its age, and that the largest patches date from the time the tea was planted, the existence of small patches indicates original infection after the tea became mature. Spore infections are extremely rare (if they ever occur direct to the tea), so it must be assumed that the dispersal of the disease has been brought about largely by dispersal of diseased roots in the past. The prevalence of the smaller patches near roadsides supports such a conclusion.

It is unlikely that deaths have occurred without our knowledge in all the 22 new plots since 1933, so at least in some of these the last diseased bush was removed before April, 1933. It may also be assumed that the bushes which died this year were infected at the time the earlier diseased bushes were removed. It follows that at least two years may elapse before an infected bush dies under the conditions prevailing at St. Coombs. Evidence to support this conclusion has also been obtained from other estates.

From five new patches located in one field (No. 7) 21 dead or dying bushes were removed. These showed obvious above ground symptoms but the surrounding tea appeared healthy. An examination of the surrounding bushes, however, revealed that the roots of 55 more were already severely infected. On forking through the patch, 11 tea stumps were located though nothing was visible above ground to indicate their presence.



It should be noted that in the above instance two apparently healthy bushes, as judged above ground, had to be removed for each one that was obviously diseased. This aspect of the problem has not been fully realised in the past by many superintendents. So long as such infected bushes remain *in situ*, the disease is harboured and ultimately passes to other bushes. A further example may make this point clear. A large Poria Patch (3-43) had begun to invade an experimental plot and seven rows of tea within the plot were likely to be affected. The roots of the first bush in each row, *i.e.*, bushes situated on the boundary of the patch, were exposed and examined and of these seven, six had severely infected roots although no above ground symptom was visible. The six bushes were removed and the roots of the next six were examined. These were healthy. There can be no question that the six infected bushes would ultimately have died, but by that time the next six would have become infected. The removal of infected bushes together with the whole of their root systems and extraneous woody matter will, it is considered, completely eliminate the disease from that zone. Time, however, will show.

The above example also illustrates the necessity for treating a Poria patch as a whole. If treatment is limited to the obviously dying bushes and the examination of those in the immediate vicinity, it is almost certain that further treatment will be required later. For instance, if deaths occur this year on the northern boundary of the patch, treatment may be demanded next year on the southern boundary and so on.

The cost of treating the patches as a whole instead of merely removing the dying bushes, would increase the costs under "Diseases" very considerably. On the other hand the eradication of the disease is likely to be achieved and healthy tea established within a reasonable period on the site.

**Wood Rot:**—The fungi which cause the rooting of the woody frame of a tea bush normally gain entrance through pruning cuts. They appear unable to penetrate living cortex and consequently must obtain direct contact with the wood in order to become established. Although pruning wounds affords an obvious entry for such fungi they are not necessarily the only means of entry. It has been suggested that where shot-hole borer is prevalent, the galleries made by the beetles afford a favourable entrance as the beetle is likely to carry into the gallery suitable spores or infectious material, such as soil, adhering to her body. It is known that the shot-hole borer beetle cultivates within the gallery a particular fungus (ambrosia) on which the young feed, and it appears feasible that other fungi might be introduced at the same time.

When young tea which has been attacked by shot-hole borer is pruned, the wood surface of the pruning cut is often red in colour. The coloration is confined to the regions bored by the beetles, and this discoloration has been suggested to be the beginning of a wood rot. One Superintendent

writes: "The discoloration, or stain, is noticeable as soon as the branch is cut, and in bad cases, which are very frequent, it follows the borers' galleries up and down the branch and extends to the pith. At the next pruning these are the branches which are found ruined with rot."

Towards the end of 1934 branches of this type with discoloured wood were collected. The bushes had not been pruned previously and wood rot was absent from the frames. The observed discoloration was therefore unassociated with existing wood rot.

Numerous isolations from the discoloured areas of several stems were made under sterile conditions. The discoloured areas were always in the region of shot-hole borer galleries and it was not always possible to remove a fragment of wood without including a little of the gallery surface. Only two fungi however were obtained in culture, in some cases both fungi were obtained together. The fungi were (1) the ambrosia fungus, and (2) a common fungus of dead twigs — *Nectria haematococca*.

Holes were bored into the stems of young tea plants of suitable thickness and woodiness with a sterile drill, to resemble shot-hole borer galleries, and pure cultures of the above fungi were inserted. In some cases the holes were left open; in others they were covered with adhesive tape. Other galleries had sterile culture medium inserted as control.

After nine months the stems were removed for examination. In all cases the apertures were completely closed by callus and no difference could be perceived between those which had been left open and those covered by tape. When the stems were cut no discoloration could be seen around the 'control' galleries nor those inoculated with the ambrosia fungus, nor could the hyphae of the ambrosia fungus be found in the wood. This result was rather surprising as normally the ambrosia fungus invades the wood for some distance above and below the gallery. In short, the ambrosia fungus did not become properly established within the gallery in the absence of the beetle. This suggests, but does not prove, that the beetle may have a stimulating effect on the fungus.

The branches inoculated with *Nectria haematococca* showed a red discoloration immediately above and below the gallery but not at the sides. The vertical spread never exceeded one-eighth inch which was very small compared with that of the original specimens. It appears quite possible that the *Nectaria* may be the cause of the discoloration seen on the pruning cuts, and the entry of this fungus *viâ* a gallery entrance implies the possibility of others entering similarly.

Neither of the fungi under experiment would rot wood unaided. But it is possible that their presence in the wood results in some change which would render the wood more suitable for invasion and more easily decayed when invaded by suitable fungi.

**Wound Covers:**—Laboratory tests were carried out on two proprietary preparations which were suggested to be useful as wound covers for tea. The tests are admittedly severe and are intended to test the antiseptic properties of the paints and their ability to withstand weathering. The materials, here designated S.P. and S.S., were used at the strengths recommended by the makers.

*Antiseptic Properties.*—(1). The materials under test were diluted with sterile nutrient agar-agar in the ratios 1:10, 1:20, 1:30, 1:40 and 1:50. Plates were poured and inoculated with six different fungi known to be able to rot wood.

S.S.—After ten days no growth had occurred on any plate with the ratio 1:10 and 1:20. Two fungi had started growth on the 1:30 plates, four on those at 1:40 and all fungi grew when the dilution was 1:50.

S.P.—Growth occurred on all plates in seven days. As S.P. is not miscible with water it was impossible to get an even distribution of the substance through the agar-agar.

(2). Wood blocks were painted with the preparations, allowed to dry for 24 hours and then inoculated on the painted surface with 3 different fungi.

S.S.—No visible growth occurred in eighteen days.

S.P.—Visible growth occurred on the surface of all blocks.

*Surface Protection and Ability to Withstand Weathering.*—Sterile wood blocks of known dry weight, containing 50-60 per cent of moisture were painted on all sides with the materials under test. The blocks were dried for 24 hours and divided into three equal lots and treated as follows:—

1. Placed immediately on petri dish cultures of two different wood rotting fungi.
2. Placed in running water for 18 days after which time they were removed, allowed to dry until their moisture content was reduced to 60 per cent., and then placed on cultures of wood rotting fungi as (1).
3. Suspended in the open so that they were exposed to the weather, alternating sun and rain for  $3\frac{1}{2}$  months. They were then placed on cultures of wood rotting fungi as (1).

Unpainted wood blocks were treated similarly as controls.

The wood blocks were removed from the petri dish cultures after being exposed to attack by the fungi for three months, dried in an oven, weighed and the loss of weight during the experiment determined. The loss of dry weight is taken as a measure of decay brought about by the wood rotting fungi. Six painted blocks and six unpainted blocks were used for each test. The mean results are given in Table I.

TABLE I

Percentage of Loss of Weight of Wood Blocks  
After Exposure to Attack by Fungi.

|                                          | Painted with |      | Control |
|------------------------------------------|--------------|------|---------|
|                                          | S.S.         | S.P. |         |
| 1. Tested immediately after painting     | 7            | 9.5  | 10.4    |
| 2. Tested after washing in running water | 29.4         | 6.2  | 7.6     |
| 3. Tested after weathering               | 18.2         | 6.4  | 7.8     |

The very heavy loss in weight of the blocks painted with S.S. and then washed by rain or running water, suggests that this material had a chemical action on the wood, and either rendered soluble certain constituents which were washed out by the water, or made the wood more suitable for invasion and breakdown by the fungi. This effect has not been met with in previous tests of wound covers.

Judged by these standards, S.S. is detrimental unless it can be shown that the greater part of the loss in weight has not been brought about by the activities of the fungi. The results obtained from those painted with S.P. are not markedly superior to those obtained from unpainted blocks. We cannot therefore recommend the general use of either of these materials as wound covers to prevent wood rot of tea.

**Leptothyrium Theae:**—In my Annual Report for 1929 a dieback of tea branches during the first year from pruning was recorded. The same disease was again prevalent this year in several districts, and the opportunity was taken to carry out further investigations into its cause.

Attention is drawn to the disease by the presence of one or more dead shoots in an otherwise healthy bush. These are easily located as the dead leaves, dry and brown, remain attached to the dead shoot and afford a strong contrast to the normal healthy leaves. Sometimes, but not always, these dead shoots are easily detached by a sharp tug, and an examination of the broken end indicates that they were attached to the parent stem only by the central core of wood. In other words the branches appear to have been ringed at their bases, *i.e.*, the points of attachment to the main stem. This character when submitted for examination in the laboratory gave rise to the view that the ringing of the young shoot was the cause of its death and that strong winds were probably the cause of the injury. This view however could not be maintained after an examination in the field, for several reasons, of which only the most important need be mentioned here, *viz.*, that all affected shoots are not ringed. In the majority of cases the dead branch is firmly attached and there is no evidence of ringing.



The fungus *Leptothyrium theae* Petch has been isolated consistently from branches exhibiting all stages of the disease, and experiments carried out on young tea shoots maintained in water have shown that the same fungus when introduced through a wound, preferably the severed base of a leafstalk, causes a similar dieback of the shoot. Similar branches inoculated with other fungi isolated from diseased specimens remained healthy as did branches into which no fungus was introduced. The evidence therefore points to this fungus, *Leptothyrium theae*, as being the cause of the disease.

The disease starts as a small black depressed spot on the young green branch. Frequently the spots are numerous. The discoloured areas enlarge until the stem is encircled when the upper part is quickly killed. The fungus advances towards the base killing the whole shoot and then enters the cortex of the parent branch, causing a dark discoloration and ultimate death of the invaded area. In advanced cases where the cortex of the parent branch is involved *Leptothyrium theae* was normally isolated from the junction of the healthy and diseased areas.

The fact that the fungus may enter the parent branch is of importance, in that in such a position it is likely to cause a true branch canker. A few such cankers have been found on branches but so far they appear to be of little economic importance.

When however the fungus becomes established within the cortex at the collar it is likely to result in the death of the bush.

A few bushes about eight years old were seen to be in a moribund condition on St. Coombs. An examination disclosed the fact that a complete ring of cortex four inches or more in breadth was dead just above and below ground level. At the upper margin a thick callus had developed and in some cases a few small roots had arisen from the callus. The lower margin was not so clearly defined until the cortex was shaved when the junction of living and dead cortex was clearly seen. In one instance a few shoots had developed on the living root. Although the dead cortex remained *in situ* the bushes were virtually "ringed". A photograph of a bush attacked at the collar is reproduced as Plate I. The upper margin of the dead tissue is shown by the callus; the lower margin is defined by a white line painted on the root.

The fungus, *Leptothyrium theae*, was isolated on many occasions from the junction of the healthy and diseased tissue at the collar of such bushes. Its occurrence in that position, in view of the fact that the fungus is known to invade the cortex of old stems constitutes *prima facie* evidence of its responsibility for the death of the cortex at the collar.

As yet we have no evidence that the fungus can gain access directly into the cortex of old stems, as early infections have been found on green stems only. The thickness of the upper callus and the fact that the roots



Plate I.

Tea bush attacked at the collar by *Leptothyrium theae*. The white line indicates the lower margin of the dead area



are very deficient in starch, whereas neighbouring healthy bushes have starch in abundance, suggest that the disease had been present at the collar for some long period, possibly best measured in years. It is therefore quite impossible to determine with any accuracy the method of original invasion. It is possible that infection occurred in a green stem arising near the collar when the plants were quite young. The stem would then die back and the fungus enter the cortex of the main stem. In the course of time the fungus would extend its area of infection till the main stem was completely encircled. Callus would then begin to be formed at the base of the stem and the food reserves within the root would gradually be used up, and so lead to the death of the bush.

The fact that invasion by *Leptothyrium theae* may result in the death of the bush raises the status of this disease from minor to major importance. The disease is most noticeable when green shoots are invaded and killed. Such dead branches should be removed not merely by pulling out or cutting the dead branch; the parent stem should be pruned below the point of attachment of the diseased branch.

**Crotalaria Leaf Spot:**—In July a new disease of *Crotalaria anagyroides* was observed in the Hatton district and later was found in the Maskeliya district on *Crotalaria usaramoensis*. It seems probable that it will be found in most of the wetter districts of Ceylon where *Crotalaria*s are grown. The leaves of the diseased plants at first bear numerous spots, dark purple or almost black in colour, of irregular shape and up to three or four millimetres in diameter. Occasionally the spots coalesce to form larger blotches. Later, the leaflets fall, leaving the petioles (leafstalks) bare, projecting from the stem.

The disease is caused by a fungus which will be described more fully elsewhere. The spores are of the *Pestalozzia* type, *i.e.*, they are elongate, multiseptate, dark coloured, with hyaline end cells, and bear three or four hyaline setae on the apical cell; they are not produced however in acervuli but are borne singly or in pairs on short conidiophores on both surfaces of the leaf. For the time being the fungus is classed as a species of *Ceratophorum*.

Numerous isolations have been made and inoculation experiments have been carried out successfully. Infection occurs within 48 hours under humid conditions. As yet the disease has not been found on plants other than *Crotalaria*s and attempts to transfer the disease to other plants, particularly tea, have failed. There is therefore no evidence that this disease will attack tea.

The writer is indebted to Mr. R. P. Shakespeare for the following field observations and for material assistance afforded for the study of this disease.



October 9th, 1935 :—"It may interest you to know that I sowed some *Crotalaria anagyroides* seed in my nursery, amongst older plants, for seed bearers, and as soon as the young plants had grown to two inches they were attacked by the fungus from the old plants and nearly all killed off. Where I have planted the same seed in a field, however, it is thriving well. There are no old plants with the disease nearby."

October 31st, 1935 :—"The recent rain has resulted in the loss of all but one or two seedlings which were planted near old *Crotalaria* in the nursery. From the taller seedlings (2 or 3 inches high) the leaves have all gone and the stems are going black from the top downwards. It is noticeable that in the places furthest away from the old plants the seedlings are not affected so badly yet."

"The *Crotalaria* planted in the field where there are no old plants anywhere near is coming on splendidly and I have not yet seen any signs of the fungus despite the rain."

November 13th, 1935 :—"I have found one or two small patches of the disease in the newly planted field where the *Crotalaria* is coming on so well. The patches are so small they make no difference to the crop and do not appear to be spreading. About a week ago I pulled up a patch about two yards long and find that since doing so the rest of that particular row has not been affected by the fungus. The *Crotalaria* is now about six inches high and there is a good cover, and from past experience I do not feel that any serious harm can now come to the crop especially as we are now approaching the drier season."

"I have sown a new nursery far away from any affected areas and the seed is already coming up splendidly."

November 18th, 1935 :—"There are now a number of patches of the disease to be seen in different parts of the field sown with *Crotalaria*. These patches appear to have no connection with each other; one row of *Crotalaria* may be severely affected while the next, which is two rows of tea away, is completely unaffected. Though the spread down the affected row appears to be fast it is significant that, where there is a natural break, or an artificial one such as I have made in a row, the fungus has not jumped this portion and has been arrested. The new nursery is at present doing well."

November 25th, 1935 :—"With regard to my new *Crotalaria* nursery, there is an *Acacia* tree at one end and I planted seed right up to the tree. The *Crotalaria* is now two inches high. That around the *Acacia* is affected by the disease but elsewhere it is perfectly healthy."

January 5th, 1936 :—"The new *Crotalaria* nursery has suffered from the attack of the fungus during the continuous wet weather we had throughout December, and I have lost fully 50 per cent of the young plants. Since

the recent dry weather quite a number of the young plants which were not completely destroyed are beginning to make fresh growth from the bare stems. The *Crotalaria* is not much more than three inches high even now but unaffected plants appear perfectly healthy."

"I have not resown the old nursery since November. All the young plants obtained from two sowings were destroyed but the old plants are now healthy again and are in flower."

"The field I sowed and mentioned in previous letters is now well covered with a good growth of *Crotalaria anagyroides*, which will shortly be ready for lopping with the exception of the patches which were attacked by the disease, probably not more than 10 per cent of the whole area. Some of these will be lost but others appear to be coming back."

"With regard to the artificial breaks to stop the spread of the disease, I have found them quite effective if the rainy weather is not continuous over a long period. In continual wet weather like we had last month, a break though holding the fungus up for a time could not prevent the spread of the disease over the requisite period."

As evidenced above the disease is essentially one of wet or misty weather; the spores are mainly produced under those conditions. To young plants the disease frequently proves fatal but if well grown, six inches or more in height, before being severely attacked the plants normally recover as soon as fine weather sets in. The old diseased foliage is shed and the new growth remains healthy until climatic conditions favour another attack.

It is feared that this disease is likely to prove a serious handicap in the successful cultivation of *Crotalaria* as green manure in certain districts. Where this disease assumes serious importance it is advisable to grow other plants, e.g., *Tephrosia vogelii* for a year or two before again attempting a species of *Crotalaria*. A rotation of bush manures is likely to prove of advantage.

**Gliricidia Disease:**—In July a disease of *Gliricidia* was observed for the first time in the Dimbula district on the green stems. Branches up to half-an-inch in diameter were attacked. The disease begins as a dark purple, almost black spot which increases in area, and becomes sunken. Later the affected area becomes grey with a black or dark purple margin; the cortex frequently falls off and exposes the wood. These lesions, or cankers, may become two inches long and usually they encircle the stem. If the stem is completely ringed, the upper part of the branch dies. Frequently, however, the affected branches break in the wind and the upper part hangs downwards. Even if the stem does not break, the part above the canker dies if the branch is completely encircled. The fructifications of the fungus can be seen as minute black dots on the grey area of the lesion. Dark purple spots also occur on the petiole, and the fungus which causes them is the same as that which attacks the stems.

The causative fungus is a species of *Phoma* with black erumpent, ostiolate pycnidia, 70-150  $\mu$  in diameter. The spores are oval, hyaline, mainly  $6 \times 3 \mu$  Basidia, simple. No paraphyses.

The fungus was grown in pure culture and used for inoculation experiments. On *Gliricidia* cuttings maintained in water, infection occurred very readily through wounds when the surrounding atmosphere was kept humid. The first indication of infection was a water-soaked appearance of the cortex around the wounds (needle pricks); later the area became dark purple. In five days the lesions were as much as half-an-inch long and almost encircled the stem.

Attempts to infect unwounded stems failed but there can be little doubt that natural infections occur in unwounded stems although many cankers occur at the nodes as though infection occurred through leaf scars. Attempts to infect tea also failed. In the field no indication of the tea being affected could be found, and it appears unlikely that this disease will spread to tea.

**Clitoria Cajanifolia**:—Diseased leaves of *Clitoria* which had been grown as hedges above road banks were submitted for examination in December. The disease occurred as large blotches involving in some cases practically the whole of the leaflet surface. The discoloration was greyish-brown, more apparent on the upper surface than the lower; on the lower surface the grey colour predominated. Associated with the disease was a species of *Phyllosticta*, which produces pycnidia on the upper surface of the leaf only. The pycnidia are black spherical, erumpent, the diameter varying from 70-150  $\mu$ , though mainly about 100  $\mu$ . The spores are hyaline, cylindric with rounded ends  $5.7 \times 2.3.5 \mu$ .

**Tephrosia Vogellii**:—*Rosellinia arcuata* which causes a root disease of tea has been found on the roots of *Tephrosia*.

C. H. GADD,  
*Mycologist.*

# REPORT

OF

## THE ENTOMOLOGIST

FOR 1935

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**Staff:**—The Entomologist returned from leave on January 28th and assumed duties the following day.

**Advisory Work:**—633 letters were received and 645 despatched; and 238 parcels of specimens received for examination and report.

**Passara Sub-Station:**—During the year, a new laboratory was built at Passara. The growing work of the station which includes both entomological and agricultural investigations required improved facilities, and the present laboratory is a welcome development. It is constructed in such a way that if additions are required in the future, they can be made with a minimum of inconvenience. A new bungalow also was erected close by for the Assistant Entomologist, and another rented for the field assistant.

**Trichogramma and Tortrix:**—A second field experiment with the egg-parasite was carried out in the early part of the year, and on the same lines as the previous one. The main problem was to discover whether it might prove a favourable factor in the suppression of Tortrix. As anticipated, the result was negative. The chief reasons for this were the complete independence and non-overlapping of the Tortrix generations, and the short life cycle of *Trichogramma* which cannot span the gap existing between oviposition in succeeding generations. An account of this experiment was published in *The Tea Quarterly*, Vol. VIII, Part III, page 140.

Tortrix appears to have been less in evidence than usual during the year. Maskeliya, which not long ago suffered considerably from this pest, was relatively free. Such a state of affairs is somewhat contrary to expectation, since previously Tortrix has made considerable headway in dry seasons, and 1935 was remarkably dry. It is possible that the intensive collection of egg-masses carried out during the last few years was a contributory cause.

**Insectory:**—It has now been sufficiently demonstrated that egg-parasites of the genus *Trichogramma* are unlikely to be of any value as a controlling agency for Tea Tortrix (*Homona coffearea* Nietn.), and that even if they were, it would not be economically feasible to provide them every year.\* Consequently, the work has been discontinued, and the rooms used for mass breeding were altered in order to make an insectory.

**Parasites from Java:**—Following the visit of the Chairman and Director to Java early in the year to get in touch with tea interests there, arrangements were made with the Director of the Institute of Plant Diseases in Java

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\* See *Tea Quarterly*, Vol. VI, p. 166. . .



to send a consignment of Tortrix parasite material for trial and observation; this was received by mail steamer near the end of November. Seven species of parasites were reared from this, of which six have not hitherto been found in Ceylon. Of these six, two species were represented only by one male each and were therefore of no value. Of the remaining four, a few individuals, including females, were reared from three species, while of the last one, several hundreds emerged. If utility is represented by numerical superiority, then this one may be valuable, if of course, it can adapt itself to the conditions existing here. Much observational work will be necessary in the future to determine its status in the Tortrix complex.

**Parasites for India:**—At the request of the Entomologist of the Indian Lac Research Institute, a number of *Braconid* parasites of the species *Microbracon hebetor* were reared and despatched to India. The purpose of these was to assist in suppressing one of the more important caterpillar predators of the lac insect.

**Insects and Made Tea:**—During the year complaints were received of consignments of tea being contaminated by insects. Investigations were carried out in Colombo for some months in connection with this matter, and a report drawn up.

**Nettle Grub:**—Attacks of this pest were much diminished in 1935 compared with years back to 1931 when investigation started. The number of attacks reported is given in Table I for each year from 1931-1935 inclusive. The figures are obtained from the monthly returns submitted by estates, 111 of which are issued with cards for the purpose. On an average, only 55 of these used their cards; therefore a general account of the development or otherwise of Nettle Grub infestation in Uva necessarily remains somewhat fragmentary. Table II shows the distribution of outbreaks in Uva during the year, and Figure I gives a similar record graphically for each year from 1931 to date. It will be noticed that the number of such reports reaches a maximum in the middle months of each year, recalling the statement that Nettle Grubs are a dry weather pest. Apart from Uva, one outbreak each was reported from Elkaduwa, Matale, Kurunegala and Dolosbage.

Apart from a decrease in the number of attacks, their severity was less than previously. This is reflected in the fact that control measures were mainly limited to the collection of grubs and cocoons, and little spraying was done.

Various insecticides were again the subject of experiment, but as yet nothing can be recommended to supersede plain soap and water. A colloidal form of barium silicofluoride was tested as a stomach poison, but proved quite valueless. An ovicide consisting of varying proportions of kerosene and liquid fuel was found to be highly satisfactory in its effect, destroying 100 per cent of all eggs it reaches, without affecting the foliage. It is applied with a small hand atomiser. The chief difficulty lies in spotting

TABLE I.  
*Nettle Grubs in Uva 1931-1935.*

| Planting District        |                                    | 1931   | 1932   | 1933   | 1934   | 1935   |
|--------------------------|------------------------------------|--------|--------|--------|--------|--------|
| Badulla                  | Average No. of outbreaks per month | 7.5    | 5.3    | 6.6    | 5.0    | 3.5    |
|                          | Average acreage affected per month | 373    | 439    | 333    | 217    | 143    |
|                          | Acreage under tea*                 | 32,600 | 33,000 | 33,200 | 33,300 | 33,300 |
| Passara                  | Average No. of outbreaks per month | 7      | 4      | 4.5    | 7.5    | 9      |
|                          | Average acreage affected per month | 727    | 390    | 250    | 551    | 229    |
|                          | Acreage under tea*                 | 9,800  | 9,800  | 9,850  | 9,850  | 9,850  |
| Haputale & Haputale West | Average No. of outbreaks per month | 2      | 1      | 0.5    | 0.2    | 0.25   |
|                          | Average acreage affected per month | 180    | 46     | 22     | 0.2    | 7.5    |
|                          | Acreage under tea*                 | 25,600 | 25,600 | 25,700 | 25,800 | 25,800 |
| Madul-sima and Lunugala  | Average No. of outbreaks per month | 2      | 0.2    | 1      | 0.5    | 0.5    |
|                          | Average acreage affected per month | 101    | 1      | 43     | 5      | 5      |
|                          | Acreage under tea*                 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Uva                      | Average No. of outbreaks per month | 18.5   | 10.7   | 12.5   | 13     | 10     |
|                          | Average acreage affected per month | 1,381  | 876    | 648    | 773    | 384    |
|                          | Acreage under tea*                 | 78,000 | 78,400 | 78,750 | 78,950 | 78,950 |
|                          | Percentage infection per month     | 1.77   | 1.12   | 0.81   | 0.98   | 0.49   |

\* Figures obtained from Ferguson's Directories 1931-1935.

TABLE II.

## SUMMARY OF NETTLE GRUB OUTBREAKS IN UVA DURING 1935.

*(Data gathered from returns supplied by estates in Uva).*

| Month     | Badulla District* |                  |                  | Passara District |                  |                  | Other Districts** |                  |                  | Whole of Uva     |                  |                  |
|-----------|-------------------|------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|------------------|
|           | Estates affected  | No. of outbreaks | Acreage affected | Estates affected | No. of outbreaks | Acreage affected | Estates affected  | No. of outbreaks | Acreage affected | Estates affected | No. of outbreaks | Acreage affected |
| January   | 1                 | 3                | 60               | 3                | 8                | 360              | —                 | —                | —                | 4                | 11               | 420              |
| February  | 1                 | 2                | 38               | 3                | 5                | 239              | —                 | —                | —                | 4                | 7                | 277              |
| March     | 2                 | 4                | 179              | 3                | 6                | 340              | 1                 | 1                | 1                | 6                | 11               | 520              |
| April     | 2                 | 4                | 163              | 3                | 7                | 429              | 1                 | 1                | 10               | 6                | 12               | 602              |
| May       | 3                 | 5                | 156              | 4                | 9                | 414              | 2                 | 2                | 25               | 9                | 16               | 595              |
| June      | 3                 | 6                | 262              | 4                | 10               | 364              | —                 | 1                | 30               | 8                | 17               | 656              |
| July      | 2                 | 4                | 226              | 4                | 8                | 214              | —                 | —                | —                | 6                | 12               | 440              |
| August    | 1                 | 1                | 60               | 3                | 6                | 141              | —                 | —                | —                | 4                | 7                | 201              |
| September | 1                 | 2                | 39               | 2                | 2                | 64               | —                 | —                | —                | 3                | 4                | 103              |
| October   | 3                 | 5                | 257              | 2                | 2                | 37               | 1                 | 1                | 60               | 6                | 8                | 354              |
| November  | 1                 | 2                | 32               | 2                | 3                | 69               | 2                 | 2                | 23               | 5                | 7                | 124              |
| December  | 2                 | 4                | 240              | 2                | 3                | 72               | —                 | —                | —                | 4                | 7                | 312              |

\*Including Namunukula.

\*\*Including Haputale, Madulsima and Lunugala Districts.

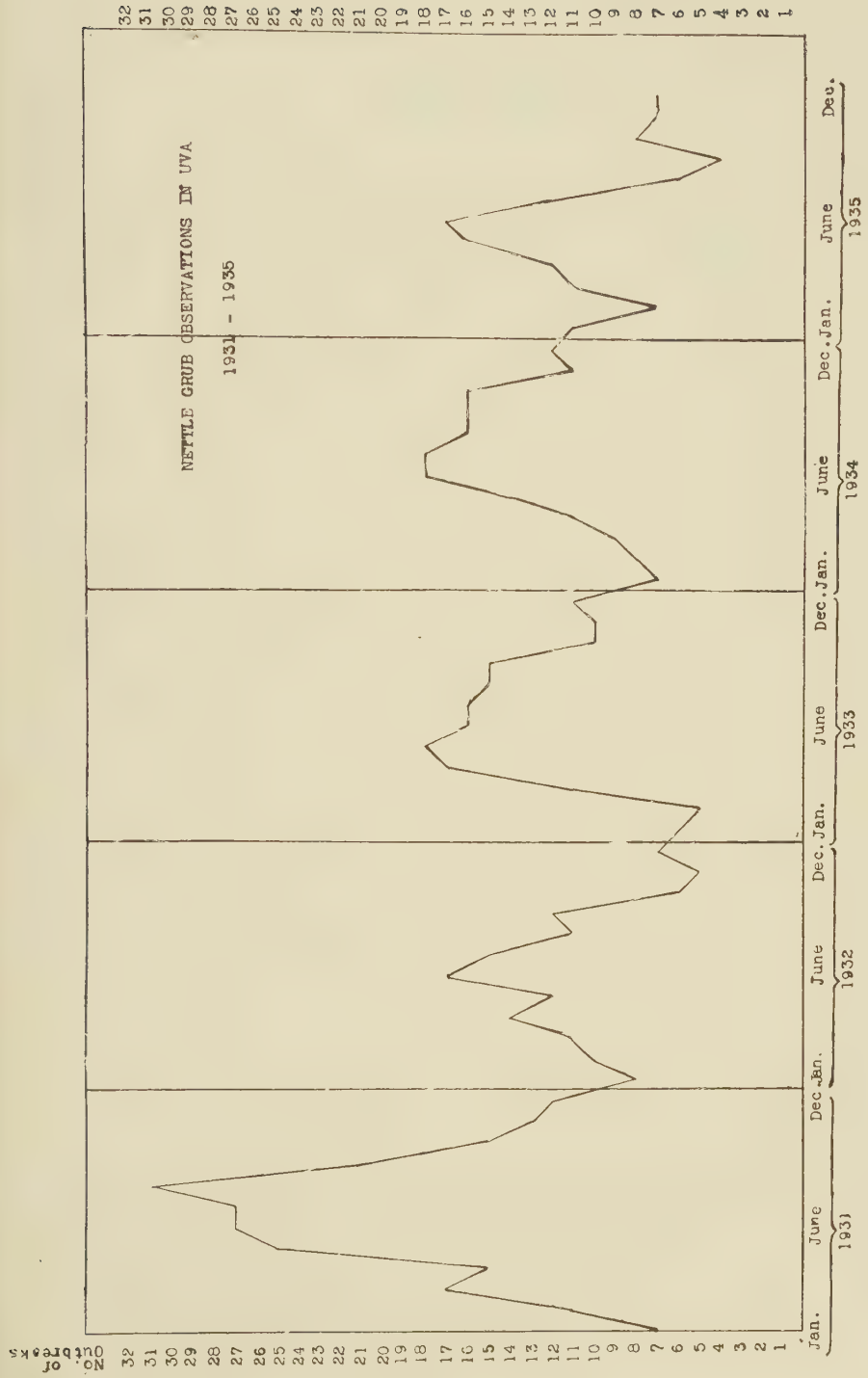


Figure I.



the eggs, especially when they are not being specially sought. Further work will be necessary before recommendations can be made.

For some time past it has been obvious that improvement in the technique of spraying for Nettle Grub must come by developing a machine particularly suited to the purpose in view. Various firms in Ceylon, England and the United States were consulted with a view to procuring a suitable machine, and at length Messrs. Ernest H. Hill of Sheffield agreed to turn one out to specification for trial. As a result of this, it is expected that a suitable machine will shortly become available, that is both cheap and efficient. Arrangements will be made to demonstrate the machine at Passara to those interested.

**Other Pests:**—Red borer, *Zeuzera coffeae*, was the most commonly reported pest. This caterpillar bores in tea branches, and if it appears in a nursery, may kill a young plant. Although locally its damage may be considerable, it is not very common and cannot be classed as a first-class pest.

*Prodenia litura*—is a caterpillar having a rather greasy appearance. It is greyish green or brown in colour and reaches about two inches in length. In every case reported so far from tea estates, its principal and original food plant appears to have been *Oxalis*. As it occurs in swarms and is very voracious, it soon finishes this and turns its attention to something else, if not full grown. It appears only to attack tea out of sheer hunger, and then only the old and coarse leaf. It is not a primary pest of tea. *Podomyia setosa*, a fly parasite of the family *Tachnidae*, has been reared, from it, but it appears to be rare.

Tea seed fly, *Adrama austeni*.—This was reported in three different places at about the same time. A close relative, *Adrama determinata*, attacks germinating seedlings in Java, if the cotyledons happen to be exposed. There is no evidence in Ceylon yet that *Adrama austeni* is a pest. All attempts to breed this fly have failed, and it seems most probable that the fly only lays in an unhealthy seed and is attracted thereto by decomposition products.

An unusual insect was sent in from Matale. Numerous caterpillars of the butterfly, *Parata chromus*, were found pupating in the larger leaves of tea bushes, tying the edges together in three or four places with strong silken threads. They had previously fed on mahogany trees.

A report that Tortrix moths were flying in some numbers across an estate was sufficiently interesting to justify an immediate visit to see it. However, the moths turned out to be *Nepita conferta*; they are about half-an-inch in length, orange in colour, with brown wavy lines across the wings. The caterpillars may often be found in the neighbourhood of buildings and are provided with extremely irritant hairs.

C. B. REDMAN KING,  
*Entomologist.*

# REPORT

OF

## THE AGRICULTURAL CHEMIST

FOR 1935

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**Staff:**—Mr. C. A. de Silva resigned his appointment as Research Assistant with effect from 31st August. Mr. J. G. Shrikhande, M.Sc., (Nagpur), Ph.D. (Lond.), A.I.C. was appointed to fill the vacancy. Dr. Shrikhande takes up his duties in the New Year.

**Correspondence:**—The Department received 465 letters and despatched 451; these figures again show an increase in advisory activities compared with the preceding year.

**Estate Visits:**—Seventeen visits were made to seventeen estates for advisory purposes.

**Sub-Stations:**—Nine visits were made to Sub-Stations.

**Visitors:**—In addition to those visiting the Institute on the monthly visitors' day, the Agricultural Chemist held discussions on specified topics, by appointment, with 29 visitors.

**Lectures:**—Eight addresses were given to Planters' Associations and kindred bodies. The substance of most of these has appeared in *The Tea Quarterly*. The following are the details of subject and place:—

“The Economics of Manuring”—Kandy District Planters' Association.

“The Indore Compost Process”—Dickoya District Planters' Association; Dimbula District Planters' Association; and the Standing Committee on Agriculture, Planters' Association of Ceylon.

“Organic and Inorganic Manures”—Sabaragamuwa Planters' Association.

“The Cultivation of Tea”—Nuwara Eliya Planters' Association.

“Tea Culture in Ceylon”—Darjeeling Planters’ Association and the Hailakande Circle of the Surma Valley Branch of the Indian Tea Association.

**Tour of North-East India:**—In continuation of the policy of exchange of visits by research officers, the Agricultural Chemist visited the tea districts of North-East India from October 30th to December 9th. In the course of his tour he stayed in the following districts: Darjeeling, Jorhat, Dibrugarh, Doom-Dooma and Cachar. He also spent ten days at the Indian Tea Association Experimental Station at Tocklai. A report on this tour is in course of preparation.

**Acknowledgments:**—The Department is much indebted to the Superintendents, Agents and Proprietors of Gonakelle Estate, Passara, and Wikiliya Estate, Balangoda, for the co-operation in, and facilities for, experimental work on these estates.

It is a pleasure also to thank all who, by providing hospitality and by other means, combined to make the tour of the North-East Indian tea districts so pleasant and instructive. Their number precludes individual mention in the present report.

**Publications:**—The following are papers published in journals other than the Institute’s *Tea Quarterly*:—

“Studies in the Yield of Tea”—III, Field Experiments with Potash and Nitrogen in Relation to the Pruning Cycle in *Empire Journal of Experimental Agriculture*, 1935, Vol. 3, pages 105-118; and “The Development of Field Experiments in Agricultural Research” in *The Tropical Agriculturist*, 1935, Vol. 84, Nos. 2, 3 and 4.

**Organic Composts:**—In the Report for 1934 a number of questions were raised regarding the adoption of the Indore compost process on Ceylon tea estates. During the year under review not only has a great deal of advisory work been carried out on this subject, but time has been largely devoted to investigational work bearing on the aforementioned questions. The general trend of the information gathered during the past year has been given from time to time in lectures published in *The Tea Quarterly*. These will be summarised here and details of the laboratory control of the process will be dealt with.

Experience has shown that the waste products available on tea estates consist largely of tea prunings and green manures. This is specially true of densely planted up-country districts. Costs of manufacture consequently

vary enormously according as the materials used consist mainly of these two classes of green material, or waste material from land not under tea cultivation. In the former instance, the cost of lopping or pruning is accounted for before the material is collected for composting, and the cost of manufacture is thus more favourable than in the latter instance where special labour has to be used. In eight cases where costs have been carefully compiled, the cost per ton ranges from Rs. 1.64 to Rs. 6.83 per ton exclusive of distribution and for the latter charge the average cost is Rs. 2.00 per ton. Low costs are naturally associated with the use of large quantities of green manures and prunings. High costs corresponding with the estimate of Rs. 8.00 per ton originally published by the Institute, come from estates which have not used sources of vegetable material which were already in direct use as green manure or mulch.

The prevalent use of prunings and green manures grown amongst the tea as material for composting has narrowed considerably the point at issue. Since few are able, by reason of scarcity of outside material or by prohibitive cost of transport, to use exclusively material from waste land, the question needing most consideration is whether a gain results from composting prunings and green manures commensurate with the cost of production, even at the lower rates prevailing under these new conditions.

There are two well-defined circumstances under which composting has a vital contribution to make in agricultural practice :—

- (1). When materials are used in which the carbon-nitrogen ratio is too high for their immediate application.
- (2). When the time period for nutrient uptake by the plant is limited to a particular period in its life-cycle.

These two circumstances are of major importance in systems of agriculture where the residues are largely derived from annual crops, and where the crop on which they are to be used is also of the annual variety. Under the circumstances now developing in tea cultivation neither of these conditions is fulfilled, so that a diminished usefulness is probable from the composting process.

In the enthusiasm of advocacy of the composting process these points have received scant attention, since it is only recently that the extension of the process to perennial crops has come into prominence. Their relevancy has not been put to any experimental test. With a view to supplying this vital information the Institute has laid down a field experiment on Wikiliya estate. The general design of this field trial follows that in use at the central research station and the sub-stations, so that results of known accuracy can be procured. The scheme of treatments is conveniently shown in the following diagram.



|                                                   | No compost | Compost<br>10 tons<br>per acre | Green manure equi-<br>valent to compost<br>at 10 tons per acre |
|---------------------------------------------------|------------|--------------------------------|----------------------------------------------------------------|
| No artificials ..                                 | 1          | 2                              | 3                                                              |
| Artificials supplying<br>Nitrogen 40 lb. per acre | 4          | 5                              | 6                                                              |
| Phos acid 30 " " "                                |            |                                |                                                                |
| Potash 20 " " "                                   |            |                                |                                                                |

There are thus six treatments represented by the points of intersections, marked by the numbers, giving all possible combinations of organic material with artificial manures. The kind of information obtainable from such an experiment may be briefly summarised.

In the first place, it will be noticed that a standard and apparently arbitrary quantity of artificials has been used. It is unfortunately impossible to determine chemically how much of the plant nutrients in compost of green manure is naturally available to the growing crop: a recent publication from the Imperial Bureau of Soil Science suggests not more than half. It is for this reason that a well-established standard mixture has been employed in this experiment. A comparison of treatments 1 and 2 or 1 and 3 respectively will show the benefits of compost and green manuring. Treatments 2 and 3 will reveal any superiority or otherwise of compost over direct incorporation of green manures in the soil. If treatments 2 and 3 are tested against treatment 4, remembering the proportional relationship between yield and artificial nitrogen reported last year, some estimate of readily available nitrogen in compost and green manures will be possible. Green manures are very frequently forked in with artificial manures, and in the soil undergo processes analogous to those of composting with urine, etc., in a compost heap. Information on the relative efficiency of these two processes under our conditions will be available from treatments 6-5. The costs of all the manures are known. The Wikiliya compost costs are amongst the lowest in Ceylon so that a comparison of monetary values will not be vitiated by high overhead charges. Over a term of years any slow-acting, cumulative advantages of compost will have an opportunity of demonstrating themselves, if such there be. Finally, if artificials act more beneficially in conjunction with an enhanced reserve of organic matter, the difference between treatments 5-2 and 4-1 will show up this feature.

**Composition of Ceylon Compost:**—When the manufacture of compost in Ceylon was first attempted, it was only natural that the best method of manufacture and the character of the final material should be problematical. The Department therefore has co-operated closely with Wikiliya estate, and has acted in an advisory capacity throughout the experimental phase of the work there. In addition, samples from other centres have been analysed in order to obtain a general idea of the type of compost that can be turned out in Ceylon with the materials at our disposal.

Altogether one-hundred-and-twenty chemical determinations have been made on these samples. Complete analysis has not been aimed at. Our object has been to carry out such determinations as will give satisfactory information for the control of the process. As an illustration of this control a representative selection of analyses is tabulated below.

Table I gives results from the Wikiliya large-scale experiment where the manufacture is now proceeding as a highly organised routine operation under standard conditions. The chief interest lies in the various materials used, and in the reproducibility of the finished product. With the exception of the moisture content, which is expressed as a percentage of the weight of the crude material, all analytical data are calculated in terms of dry weight to make them directly comparable.

TABLE I.  
ANALYSES OF COMPOST

*Wikiliya.*

| Material used                                                     | Sample No. | Moisture | Nitrogen (on dry weight) | Loss on Solution | Humification | Residue |
|-------------------------------------------------------------------|------------|----------|--------------------------|------------------|--------------|---------|
| Weeds, Gliricidia leaf and green stem, Indigofera and manna grass | 1          | 62       | 1.41                     | 26.8             | 79           | 66      |
|                                                                   | 2          | 62       | 2.06                     | 40.2             | 77           | 48      |
| Do. with some woody matter                                        | 3          | 62       | 1.80                     | 34.3             | 81           | 58      |
|                                                                   | 4          | 61       | 1.74                     | 36.1             | 74           | 51      |
| Line refuse, Gliricidia with woody matter                         | 5          | 52       | 1.13                     | 27.4             | 72           | 62      |
| Prunings, Gliricidia and Grevillea loppings                       | 6          | 67       | 2.14                     | 39.5             | 56           | 30      |
|                                                                   | 7          | 69       | 2.22                     | 40.9             | 72           | 42      |
| Manna grass, Grevillea, Gliricidia, prunings and line refuse      | 8          | 60       | 1.26                     | 23.2             | 54           | 57      |
|                                                                   | 9          | 64       | 1.62                     | 33.2             | 60           | 45      |
|                                                                   | 10         | 53       | 1.16                     | 22.2             | 62           | 64      |

The second column shows that although considerable variation occurs in nitrogen content, a high standard is maintained throughout. None of the figures falls below one per cent, and the general average is high. Satisfactory manufacture is however not merely a question of conserving nitrogen. A reasonable nitrogen figure can sometimes be obtained without the process of humification proceeding to an adequate extent. The figure for loss on solution or oxidation gives a measure of how much vegetable material has been turned into humus, and expressed as a percentage of total organic

matter provides an index figure for humification. Finally, the residual material, mainly ignited soil, affords a useful check on the interpretation of the other figures.

Samples 1 and 2 represent parallel pits in the sense that similar materials were used. No quantitative control was exercised in the proportions of the various types of vegetation that were used. Both are satisfactory samples showing roughly equal humification. The higher loss on solution for No. 2 is mainly due to the greater quantity of organic matter present. This is confirmed by the lower value for residue. Note that a high value for residue will have the effect of reducing the percentage nitrogen in the analysis, but has no diluting effect on the humification index.

Samples 3-5 inclusive came from compost with a certain amount of green woody matter in the form of the thin branches of *Gliricidia* loppings. In strictly moderate quantities, this tougher material has not adversely affected the quality of the compost: nitrogen and humification are quite up to standard. The final sets 6-10 are of interest because of the use of a considerable amount of prunings. There is nothing exceptional in the nitrogen figures but a decline in humification is noticeable, except in sample 7.

It has been noticeable with heaps made from prunings and other rough material that the scheduled three months are insufficient for the completion of the fermentation: the heaps are still hot after ninety days. In the case of samples from other centres we have not the same knowledge of the technique or materials used as in the case of Wikiliya Estate, but several important points arise from the analyses in Table II.

TABLE II  
ANALYSES OF COMPOST

*Other centres.*

| Sample | Moisture | Nitrogen | Loss on solution | Humification | Residue |
|--------|----------|----------|------------------|--------------|---------|
| 1      | 46       | 0.98     | 29.2             | 78           | 63      |
| 2      | 43       | 1.04     | 22.1             | 68           | 68      |
| 3      | 55       | 1.09     | 23.4             | 70           | 67      |
| 4      | 14       | 0.48     | 8.6              | 61           | 86      |
| 5      | 46       | 0.80     | 19.2             | 78           | 75      |
| 6      | 42       | 0.78     | 18.0             | 75           | 76      |
| 7      | 49       | 1.22     | 22.7             | 76           | 70      |
| 8      | 68       | 4.42     | 68.8             | 84           | 19      |
| 9      | 41       | 0.93     | 16.5             | 73           | 77      |
| 10     | 35       | 1.75     | 39.5             | 73           | 46      |
| 11     | 26       | 0.26     | 9.0              | 59           | 85      |
| 12     | 67       | 1.33     | 4.2              | 9            | 54      |

Several sub-standard analyses are noticeable in the nitrogen column. Sample number 4 is a definitely poor compost: the cause is traceable from the other details. Humification is not noticeably bad, so the type of material used cannot altogether be blamed. The residue however is disconcertingly high and is certainly one cause of the poor result. The "compost" is in fact largely soil. Of the vegetable matter used 70 per cent was manna grass and weeds neither of which is high in nitrogen content.

A similar instance occurs in sample 11. This again was a weed sample. Humification is on the low side, and the residue is unduly high. Where weeds and wild grasses are used it is inevitable that, unless special precautions are taken, a large quantity of soil will adhere to the roots and find its way into the pits. It seems evident that weeds should not form the major portion of the material used, and that after being allowed to wither, they should be shaken with a fork to release adherent earth before being composted.

Sample 12 is peculiar in a different respect. Its nitrogen content is good and the residue is no higher than in many cases that have provided good compost. But the humification is poor in the extreme. The explanation for this is that too much woody matter has been used and the fermentation has consequently not proceeded normally. Such material of high nitrogen content as has been present has fermented, and has bolstered up the nitrogen content. For reasons entirely different from the preceding cases, this sample cannot be labelled compost.

Sample 8 is unique. It shows the highest nitrogen content and the completest humification. The nitrogen content is in fact so high that composting of the original materials may be judged to be quite unnecessary and wasteful. The materials in question were largely refuse tea and sunflower loppings, both highly nitrogenous bodies. When materials of this type are composted alone, there is a certainty of nitrogen being lost in the process, for composting processes only work well within quite narrowly defined limits of carbon-nitrogen ratio. Substances of high nitrogen content should never be used alone, but only mixed with other constituents less rich in nitrogen.

In the series of lectures and articles that have appeared in *The Tea Quarterly*, emphasis has been placed on the conception that composting is designed to change an unsuitable carbon-nitrogen ratio into a suitable one. In the soil, natural humus, no matter how derived, has a carbon-nitrogen ratio approximating to 10. The aim of composting is to reproduce as nearly as possible this ratio. For a series of samples the carbon-nitrogen ratio has been determined on Ceylon material. The results are given in Table III.



TABLE III  
CARBON-NITROGEN RATIOS OF COMPOST

| Sample | Material used                                    | Carbon content | Nitrogen content | C/N. |
|--------|--------------------------------------------------|----------------|------------------|------|
| 1      | Prunings and rough grass                         | 21·85          | 2·22             | 9·85 |
| 2      | Weeds, cootch grass,<br>Crotalaria and Dadap ... | 8·43           | 0·80             | 10·5 |
| 3      | Crotalaria ...                                   | 8·37           | 0·78             | 10·7 |
| 4      | Sunflower ...                                    | 10·43          | 1·22             | 8·55 |
| 5      | Mixed grass and green<br>manures ...             | 18·72          | 1·77             | 10·6 |

A very close correspondence between soil and compost humus is shown in these figures, and although the samples were chosen at random, they show in samples three and four a further point of interest. The nitrogen contents of Crotalias and sunflower are high, often exceeding 2·5 per cent. The compost figures are thus low in comparison. The adjustment of carbon-nitrogen ratio can proceed in either direction, high ratios becoming stabilised by loss of carbon, low, by loss of nitrogen. These results suggest that in these samples the process has been largely a loss of nitrogen, which is contrary to the chief object of compost manufacture. Again, it must be insisted on that composting is only valuable when the original vegetable material is relatively rich in carbon and poor in nitrogen, and that any attempt to manufacture specially rich compost defeats its own ends.

Since it is not always possible to apply bulk manures as soon as their manufacture is complete, the question of possible losses on storage is of interest. In a moderately compact heap there is little to fear from storage under dry conditions. The following analyses relate to a storage heap kept for four months. In the light of inevitably large sampling errors the concordance of the analyses is satisfactory.

TABLE IV. STORAGE OF INDORE COMPOST

| Date        | Nitrogen % | Loss on solution % | Humification % | Residue % |
|-------------|------------|--------------------|----------------|-----------|
| June ...    | 1·76       | 39·5               | 73             | 47        |
| August ...  | 1·77       | 33·0               | 66             | 50        |
| October ... | 1·75       | 34·0               | 75             | 53        |

**Manurial Experiments:**—Recent advances in the technique of field experiments have enabled the experiment at St. Coombs on the effect of nitrogen and potash to be extended in the second pruning cycle to determine the effect of incremental doses of phosphoric acid also. In place therefore of a uniform application of 30 lbs. per acre of phosphoric acid, in the form of superphosphate, three levels, viz. nil, 30 and 60 lbs. per acre, have been included in the experimental design in such a way as to leave all comparisons between nitrogen and potash undisturbed.

The experiment as at present constituted gives information on all three major nutrients and their relationship one with another. The combination of three levels of nitrogen (0, 20 and 40 lbs. per acre), similar levels of potash (0, 20 and 40 lbs. per acre) and (0, 30 and 60 lbs. per acre) of phosphoric acid, gives an aggregate of 27 different treatments which, over the range of concentrations chosen, should give adequate information on which to base manurial advice.

So far, data on the first complete year only in the cycle are available, and consequently with regard to the phosphate problem their inductive value is limited. They are set out in Table V.

TABLE V  
YIELDS FROM MANURIAL EXPERIMENT

*Second Cycle 1st Year.*

| NITROGEN                 |                |                 |                 |
|--------------------------|----------------|-----------------|-----------------|
| Manurial dressing        | 0 lb. per acre | 20 lb. per acre | 40 lb. per acre |
| Yield per acre lb.       | 393            | 411             | 429             |
| Yield per cent of mean   | 95·5           | 100             | 104·5           |
| Significant difference % | 5·8            |                 |                 |

| POTASH                   |                |                 |                 |
|--------------------------|----------------|-----------------|-----------------|
| Manurial dressing        | 0 lb. per acre | 20 lb. per acre | 40 lb. per acre |
| Yield lb. per acre       | 418            | 409             | 407             |
| Yield per cent of mean   | 101·5          | 99·5            | 99              |
| Significant difference % | 5·8            |                 |                 |

## PHOSPHORIC ACID

| Manurial dressing        | 0 lb. per acre | 30 lb. per acre | 60 lb. per acre |
|--------------------------|----------------|-----------------|-----------------|
| Yield lb. per acre       | 398            | 415             | 420             |
| Yield per cent of mean   | 97             | 101             | 102             |
| Significant difference % | 5.8            |                 |                 |

## TYPES OF NITROGEN

| Types of nitrogen<br>Equivalent quantities | Sulphate of<br>ammonia | Bloodmeal | Groundnut<br>cake |
|--------------------------------------------|------------------------|-----------|-------------------|
| Yield lb. per acre                         | 422                    | 423       | 416               |
| Yield per cent of mean                     | 100.5                  | 100.5     | 99                |
| Significant difference %                   | 7.1                    |           |                   |

The effect of nitrogen is definite, and the fact that individual increments fall somewhat below the significance level is set off by the regular nature of the increments. Judged by the appropriate statistical tests it is a fair inference that nitrogen is acting favourably on yield at both levels.

This result is in contradistinction to the results in the first year of the first cycle when the yields showed small, regular, but nevertheless unreliable gains. It will be noticed that even the present results disclose only a very small increase in yield. The interpretation of these results is complicated by the fact that, during the previous cycle, the plots had naturally got completely out of step from the point of view of production, by virtue of the differing manurial applications over a three-year period. It is a question whether the effect now produced is entirely due to manures and climate in this particular season, or whether the condition of the bushes on the various plots as regards frame and reserves, even after pruning, has exerted a carry-over effect. A little more information on this point is available from a trial on similar lines at the Passara Sub-Station from first year yields of a first cycle in the trial. A comparison between the three sets of results is given below in terms of the percentage increase in crop yield due to 40 lbs. of nitrogen per acre.

|                               |     |                |
|-------------------------------|-----|----------------|
| St. Coombs 1st Cycle 1st year | ... | 4·85 per cent. |
| „ 2nd Cycle 1st year          | ... | 8·75 „         |
| Passara 1st Cycle 1st year    | ... | 3·43 „         |

The Passara result confirms very closely the comparable St. Coombs data. Arrangements are in hand for following up this interesting result by a specially designed experiment, as it is of prime importance to know more about the apparent failure of pruning mixtures to give a response commensurate with their cost, and to see whether it is related to a physiological inability in the plant to use nitrogen successfully at this particular time.

In this fourth year of the St. Coombs trial the results from the various types of nitrogen confirm previous findings that, in yield, no distinction can be drawn between the inorganic and organic sources usually employed. The potash figures also repeat the experience of previous years that no crop response is found at normal levels of fertilizer application.

The phosphate effect does not show an indubitable result as yet, but will call for comment later. As cumulative effects are felt, the response may mount to a steady level of significance. The similarity between yields at the 30 and 60 lbs. per acre levels recalls that in a separate experiment at Passara, reported last year, the same result was obtained from the same treatments.

The foregoing discussion indicates that results at the Passara Sub-Station are in accordance with those derived from St. Coombs. To complete the account of the Passara work up to date, the relative yields for the effect of the three main nutrients are reported as follows for the first year of the experiment :—

|                                     |        |       |
|-------------------------------------|--------|-------|
| Nitrogen at 40 lbs. per acre        | ...    | 101·5 |
| No nitrogen                         | ... .. | 98·5  |
| Phosphoric acid at 30 lbs. per acre |        | 100·5 |
| No phosphoric acid                  | ... .. | 99·5  |
| Potash at 40 lbs. per acre          | ...    | 101·0 |
| No potash                           | ... .. | 99·0  |

In conclusion, it may be well to state that in all reports where the difference between the presence and absence of a particular nutrient such as nitrogen is tabulated, it is understood that the trial is made in the presence of potash and phosphoric acid in the amounts stated under those headings. *Mutatis mutandis* this applies to phosphoric acid and potash. As an illustration of this principle, the aforementioned Passara experiment may be detailed, since, in addition, it shows how in a modern experiment each plot is made, to contribute to the solution of each problem.



In the following schedule N=Nitrogen; P=Phosphoric acid and K=Potash.

The treatments, eight in number, are as follows :—

O, N, P, K, NP, NK, PK, NPK.

The effect of nitrogen is determined by the difference between the two sets of four treatments grouped as shown.

|           |                   |
|-----------|-------------------|
| Nitrogen. | N + NP + NK + NPK |
|-----------|-------------------|

|             |                |
|-------------|----------------|
| No nitrogen | O + P + K + PK |
|-------------|----------------|

Similar groupings of the same eight treatments give phosphoric and potash effects.

|                 |                   |
|-----------------|-------------------|
| Phosphoric acid | P + NP + PK + NPK |
|-----------------|-------------------|

|                    |                 |
|--------------------|-----------------|
| No phosphoric acid | O + N + K + N K |
|--------------------|-----------------|

|        |                   |
|--------|-------------------|
| Potash | K + NK + PK + NPK |
|--------|-------------------|

|           |                |
|-----------|----------------|
| No potash | O + N + P + NP |
|-----------|----------------|

T. EDEN,  
*Agricultural Chemist.*

# REPORT

OF

## THE PLANT PHYSIOLOGIST

FOR 1935.

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**Staff:**—There has been no change in the staff of the division during the year. The Plant Physiologist was on leave until August 10th., 1935, during which time the Mycologist, Dr. C. H. Gadd, had charge of the laboratory and the Agricultural Chemist, Dr. T. Eden, overlooked the field experiments of the Department.

The Plant Physiologist acted for the Agricultural Chemist during the latter's absence in India in November.

**Advisory Work:**—198 letters were received and 222 despatched during the year. After returning from leave sixteen visits were made to estates.

Three lectures have been given in Ceylon, namely to the Madulkelle, Kalutara and Uva Planters' Associations. A talk upon the work of the Institute, with special reference to this Department, was given before the Ceylon Association in London on February 8th, 1934.

**Sub-Stations:**—As before, an assistant has been stationed at Galatura Estate, Kiriella, for the purpose of carrying out experiments under low-country conditions. Thanks are due to Messrs. Amalgamated Tea Estates Co., Ltd. and to Messrs. James Finlay & Co., Ltd. for the facilities provided, while Mr. J. D. Hoare, the Superintendent, has always been ready with assistance and co-operation.

The continuance of the mid-country pruning experiment situated on the Government Experimental Station, Peradeniya, was again rendered possible by the provision of facilities by the Department of Agriculture. Thanks are due to Mr. Lester-Smith, Dr. Lord, Dr. Joachim and others of the Department for their active assistance.

**Variability of Tea Yields:**—In the Report of the Plant Physiologist for 1933 is given an account of investigations upon the variability occurring in young tea seedlings, in which it was found that seed from an even type of seed-bearers produced seedlings showing an easily detachable amount of variation in their rates of growth. The practical conclusion to be drawn is that only more vigorous seedlings should be used for planting, the weaker type being ruthlessly discarded.

A very large percentage of the tea areas in Ceylon have been planted up without any attention to the need for this procedure and an examination of the actual yields of individual bushes in the field is therefore of interest. While this is only in its preliminary stages, the results are of sufficient interest to merit discussion.

The records taken consisted of the total number of shoots produced from each of one thousand bushes over a total of five pluckings. Below is shown the number of bushes occurring in each of the fifteen classes into which they were divided on the basis of their yields.

| Number of Shoots | Number of Bushes giving this yield |
|------------------|------------------------------------|
| 20-39            | 15                                 |
| 40-59            | 59                                 |
| 60-79            | 175                                |
| 80-99            | 255                                |
| 100-119          | 217                                |
| 120-139          | 134                                |
| 140-159          | 63                                 |
| 160-179          | 40                                 |
| 180-199          | 25                                 |
| 200-219          | 9                                  |
| 220-239          | 3                                  |
| 240-259          | 1                                  |
| 260-279          | 3                                  |
| 280-299          | 0                                  |
| 300-319          | 1                                  |

It is apparent that the majority of the bushes yielded rather less than one hundred shoots during the course of the five pluckings, the greatest number of bushes yielding between 80 and 99, but that considerable variations occurred in both directions, a small number of bushes yielding over double, while some yielded relatively few. Thus seventy-four out of the thousand bushes yielded less than sixty shoots, *i.e.*, less than twelve shoots per plucking.

The low yields of such bushes may be due to a variety of causes, *e.g.*, they may be supplies planted more recently than the rest of the bushes, they may be situated on poor soil, they may be diseased, or they may be inherently weak. An examination of the area of the plucking surfaces indicated that they were not all small bushes, though many were. The large number of causes which may produce a low yield renders it extremely difficult to decide whether it is advisable to uproot a poor yielding bush and plant another in its place. In view of the temporary absence of any need for high yields, it certainly appears desirable that in any case of doubt the poor yielder should not be given the benefit of the doubt but *replaced* during the normal process of supplying up the area.

It may be pointed out that these figures were obtained on an area of good uniform jât and that had an area of low mixed jât, such as is common on many estates at the higher elevations, been examined an even greater diversity of yields would have been expected.

**Resting Experiment:**—An experiment to determine the effects upon yield of resting bushes after pruning at an elevation of approximately 4,500 feet on St. Coombs Estate, Talawakelle, No. 2 Field, was terminated during the year.

The field which consisted of a "low" mixed jât, was pruned between the 10th and 20th August, 1933, the area upon which the plots were situated being pruned round about 18th August. The experimental plan consisted of twenty-seven plots, each containing two-hundred and fifty bushes, divided into nine blocks. In each block the three following treatments occurred:—

|                 |                         |
|-----------------|-------------------------|
| A. 1st tipping. | 139 days after pruning. |
| 2nd tipping.    | 158    "    "    "      |
| 3rd tipping.    | 179    "    "    "      |
| 1st Plucking.   | 188    "    "    "      |
| B. Tipped       | 229    "    "    "      |
| 1st Plucking.   | 233    "    "    "      |
| C. Tipped       | 320    "    "    "      |
| 1st Plucking.   | 368    "    "    "      |

Plucking ceased on 14th. November 1935, *i.e.*, two years and 3 months after pruning.

The tipping of the bushes undergoing treatments B and C was done on red wood, and only one tipping was necessary. The tipping levels were A  $4\frac{1}{2}$  in., B 10 in. and C 12 in. above the pruning level. The latter levels were those two which the plucking level of treatment A had reached on the appropriate date and illustrate the fact that the height of the plucking table rises quickly at first and then more and more slowly as the cycle proceeds. This is associated with the greater length of the internodes on shoots produced just after pruning compared with that on those produced later in the cycle.

During the early part of the experiment the opportunity was taken of comparing the size of the new wood grown after pruning under the three treatments. Three hundred and thirty-two days after pruning one new branch was removed entirely from each of one hundred bushes in each plot. The mean dry weight of the lowest six inches of the branches was determined for each plot. The following results were found:—

| Treatment             | A     | B     | C     |
|-----------------------|-------|-------|-------|
| Dry weight in grammes | 1·518 | 1·832 | 2·064 |



The size, measured by weight per unit length, of the new stems had thus increased by 20·7 per cent and 36·0 per cent as the result for resting three and six months respectively after the normal tipping date.

These figures illustrate the advantages that accrue from the practice of resting after pruning, especially where a rather harder pruning than normal has been used with a view to frame renewal. Where carbohydrate deficiency is not a factor affecting recovery from pruning, it is advantageous to rest after pruning rather than before, in order that the new shoots may enjoy a period of uninterrupted growth. If rested before pruning, any increase in wood growth resulting from the free growth of the bush is distributed over the frame, much of which is completely removed during the pruning operation. It is obviously preferable to restrict the advantage to those branches and new shoots which will form the bush during the succeeding cycle.

For convenience of discussion, the yield totals at the end of each ninety days (ten pluckings) are given, the first period commencing on the date of the first plucking of the control plots, *i.e.*, 22nd February, 1934. The totals for each period of 90 days are also given.

|       | A      | B      | C      |
|-------|--------|--------|--------|
| 1     | 109·73 | 11·24* | —      |
| 2     | 83·97  | 89·76  | —      |
| 3     | 99·95  | 94·45  | 77·93  |
| 4     | 130·74 | 134·68 | 122·64 |
| 5     | 135·91 | 136·83 | 127·72 |
| 6     | 69·83  | 71·02  | 70·57  |
| 7     | 88·10  | 93·59  | 91·29  |
| Total | 718·23 | 631·57 | 490·15 |

\* 5 pluckings only.

As was to be expected, resting resulted in a reduction in the crop harvested, but for practical purposes it is necessary to determine whether the loss of crop was directly related to the extra period elapsing before the tea was plucked, or whether the rested tea, when taken into plucking, yielded more or less than that which had been treated normally.

The difference in yield between A and B is 86·66 lbs. which is little different from the difference of 98·49 lbs. which was found in the first period of the series. Similarly the final difference between A and C is 220·08 lbs. of which 193·70 lbs. is accounted for in periods 1 and 2. It appears, therefore, the reduction in yield is approximately proportional to the length of time yield is delayed.

It is worth noting that the reduction in yield resulting from a six months' rest is rather more than double that found after a three months' rest. This is probably due to the fact that the production of new shoots from the more mature "red wood" takes longer than from younger stems.

F. R. TUBBS,  
*Plant Physiologist.*

# REPORT

OF

## THE TEA TECHNOLOGIST

FOR 1935.

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**Staff:**—The staff remained unchanged. Two officers have been absent on Jury service and a third was called but later excused from service.

**Correspondence:**—400 letters were received and 433 despatched, showing a slight increase on last year.

**Samples:**—689 determinations of moisture contents were carried out.

**Estate Visits:**—During the months May-August the Tea Technologist was unable to undertake any advisory visits owing to the pressure of urgent analytical work. This occasioned rather a rush at the end of the year, since advisory visits to factories occupy at least one whole day, and in several cases two days were required. For all purposes twenty eight factories were visited. This also shows an increase on last year.

**Lectures:**—The Tea Technologist gave addresses at the following meetings:—

Tea Research Conference, 1935.

Kalutara Planters' Association.

Madulkelle Planters' Association.

Kotmale and Dolosbage Planters' Association.

Matale Planters' Association.

Kandy Planters' Association.

Pussellawa Planters' Association.

Dickoya Planters' Association.

Uva Planters' Association.

Rangalla and Urugalla Planters' Association.

Dimbula Planters' Association.

**Publications:**—

Theory and Practice of Tea Drying.—*T.Q.* Vol. VIII. Pt. 1, 1935.

Report on a Test of a Marshall's "Empire" Tea Dryer.—*T.Q.* Vol. VIII, Pt. 1, 1935.

The Storage and Packing of Tea.—*T.Q.* Vol. VIII. Pt. 4, 1935.

Sulphur Taints.—*T.Q.* Vol. VIII. Pt. 4, 1935.

An Appendix to Notes on Green Sifting and Fermentation by F. R. Francillon.—*T.Q.* Vol. VIII, Pt. 4, 1935.

**Analytical:**—At the direction of the Board of Control the Department was occupied almost entirely for several months in urgent analytical work. This work was proceeded by a somewhat lengthy investigation of the analytical methods required. The enquiry was carried out successfully, and a report submitted to the Board. During this period the Department was organised in shifts, working from 7-30 a.m. to 10 p.m. Progress in other branches of work was impeded on this account.

Apart from the above investigations, other analyses have been undertaken for various firms and estates, *e.g.* :—

1. Scale from the Tubes of a Tea Dryer Stove.

|                                |     |     |        |
|--------------------------------|-----|-----|--------|
| Loss on ignition               | ... | ... | 16.25% |
| Iron in residue after ignition |     |     |        |
| calculated as iron oxide       | ... | ... | 80.00% |

In a previous case similar figures were obtained and small amounts of iron salts of organic acids were found.

2. An adhesive paste for sealing aluminium linings for tea chests.

This proved to be a flour paste containing 1.12 per cent. of copper in the form of copper sulphate as a preservative. The use of such paste was not recommended owing to the risk of copper contamination of tea adjacent to the lining.

3. A white powder found on venesta planks.

This proved to be a very fine saw dust, probably retained from the time the planks were sawn.

4. A sample of aluminium paint.

This paint contained only traces of lead and was recommended as suitable for use in or on tea factories.

5. A sample of firewood sent in for calorific test.

|                  |     |                        |
|------------------|-----|------------------------|
| Moisture content | ... | 42.8%                  |
| Calorific value  | ... | 4,958 B.T.U.'s per lb. |

This firewood was unusually wet, and inferior in this respect to wood usually burned in tea dryers. A yard of this fuel would be of much higher weight than usual and the calorific value slightly under normal.



6. A sample of coal sent in for calorific test.

|                  |     |                         |
|------------------|-----|-------------------------|
| Moisture content | ... | 1.04%                   |
| Calorific value  | ... | 13,171 B.T.U.'s per lb. |

The calorific value was slightly higher than normal, 12,500 to 13,000 being the average of tests made in these laboratories.

**Advisory:**—The problems encountered in advisory work are many and varied, making it very difficult to generalise on the subject.

Complaints of fading of tea before the actual sale in London have been less frequent than they were during 1934. In the majority of cases where complaints are made of teas deteriorating, it is extremely difficult to check up the history of the offending invoice since conditions have usually changed before investigation can be made, and it is almost impossible to get any information upon the conditions of transit and storage between the time the tea leaves the estate and the making of the complaint. Such difficulties are very greatly increased by the absence in many factories of apparatus for checking moisture contents of teas at the time of their despatch.

There is very little excuse for the lack of such equipment in any factory since it is easily available and of very moderate cost.

One case of general interest was a factory with a small out-turn, equipped with a firing machine which was too large for the normal output of the rolling room. Gaps between various dhools were, therefore, of frequent occurrence, making proper firing exceedingly difficult, and causing a high cost of firing.

To remedy this state of affairs a flexible blade was fitted on the automatic spreader making very thin spreading possible. The fan valve was closed to about half its full extent, and the oil burner reduced in order to keep the inlet temperature down to the normal figure. Further adjustments were made with the object of setting the position of the fan valve so that an exhaust temperature of 125°F to 135°F could be maintained by adjustment of spreading alone.

In the light of subsequent reports this has proved very satisfactory.

Another case of general interest was the failure of colour and "nose" of fermenting leaf to come up together. Examination of the fermenting room revealed the fact that the supply of fresh air was too limited. Attached to the fermenting room was a mist chamber, constructed on sound principles except for the baffling arrangements to remove excess of moisture. A hessian curtain was stretched across the vent of the mist chamber so that the air was, to all intents and purposes, filtered before being passed into

the fermenting room. This arrangement choked the air supply and so was replaced by a series of vertical baffles constructed of tagrams, so that the air, after humidification, passed over the top of one partition and under the next.

Subsequent results showed that difficulties experienced in fermentation had been overcome by these alterations.

In several cases improvements have been made by the adoption of better rolling programmes, arranging the length of each roll, the pressure periods, and standardising, so far as possible, the amount of pressure applied.

In the earlier rolls it is a good plan, with some types of rollers, first to follow the leaf down with the cap, and then to apply as much pressure as is possible without stopping the circulation of leaf. In many factories the charge is not weighed into the roller, but is left to the discretion of the cooly. Such practice too often results in the roller being overloaded, with the result that circulation of leaf is impeded.

Circulation of leaf is one of the most important factors in rolling. If circulation is poor, the leaf does not get mixed, and uneven fermentation results from local overheating. In addition to this, circulation implies a movement of air which also cools the leaf. If a roller is working properly a distinct gust of warm air should be felt flowing up between the cap and the jacket as the leaf turns over and pumps air out.

Alterations to roll-breaker meshes have been recommended with improvement to the evenness of infusions. In many factories the coarser mesh, in a roll-breaker with two or more different meshes, is often placed in such a position that the leaf passes over it before the finer mesh. If such a system did thorough sifting the dhool would all pass through the coarser mesh, and none would be left to pass the finer mesh. Roll breakers are often too short and fed too fast to do really efficient sifting. Green leaf sifting may be carried out quite successfully on some roll-breakers, however, and in such cases the finer mesh should be situated nearest the feed end. Where two roll-breakers are available, it may be an advantage to have the mesh uniform throughout in one — No. 4 or 5 — and to pass the bulk over this twice. The dhool from this roll-breaker can then be passed over another roll-breaker, used purely as a sifter, in which there is a fine mesh — say No. 10 — at the feed end, and No. 7 or 6 following. Such a system will give three distinct grades, and may be so designed that very little dry leaf sifting is necessary after firing.

**Tasting of Experimental Samples:—**The ultimate results of many experiments on tea manufacture depend upon the opinions given by tea tasters. It is perhaps unfortunate when the result of a chemical experiment

cannot be adjudged by chemical measurements. In many other crops where the question of quality arises chemical and physical tests have been devised, in which case the results can be expressed in figures. Such is the case with wheats used for bread making, and barley used for malting. Few pieces of scientific apparatus are, however, so delicate as the human palate, and with tea tasting there is considerable scope for differences of opinion in regard to minor variations.

For any one experiment an endeavour is therefore made to submit the successive samples to the same team of tasters.

The large number of experimental samples precludes the possibility of all being sent to one team, besides which it is sometimes of interest to have the opinion of buyers only as compared with brokers.

We have been exceedingly fortunate in being able to call upon the services of several tasters who are prepared to meet together in one office and give their opinions first individually, and after discussion collectively, upon one liquoring of the experimental samples.

A similar system has been organised in London which will afford an opinion of teas which have undergone storage and transit.

Experiments are in progress on the packing of experimental samples in order that differences due entirely to packing shall not influence the results obtained in London. Glass bottles with waxed corks have been used, and soldered sample tins, as well as evacuated sample tins, are now undergoing trial.

We are very much indebted to Mr. R. H. Horne of Messrs. Forbes & Walker, who has organised the meetings of tasters, and to the following Firms for their assistance :—

- Messrs. Forbes & Walker,
- „ James Finlay & Co., Ltd.,
  - „ George Steuart & Co.,
  - „ E. John & Co.,
  - „ Sommerville & Co., Ltd.
  - „ Whittall & Co.,
  - „ Lee, Hedges & Co., Ltd.
  - „ Lipton Ltd.,
  - „ Heath & Co.,
  - „ The Colombo Commercial Co., Ltd.,
  - „ Brooke Bond Ceylon, Limited,
  - „ Henderson & Co.,

Messrs. Harrisons & Crosfield, Ltd.,  
 „ Carson & Co., Ltd.,  
 „ Mackwoods Ltd.,  
 „ Leechman & Co., Ltd.,  
 „ Darley, Butler & Co.,  
 „ Bartleet & Co.,  
 „ Wilson, Smithett & Co., Ltd., (London).  
 „ George White & Co., Ltd., (London).

**Manufacture of Field Experiments:**—The manufacture of leaf from field experiments under standardised conditions has been carried out by this Department. The leaf from manurial, pruning, and resting experiments occupied 98 manufacturing days. Samples of the made teas have been sent for report, and the results are filed until such time as it is opportune to examine the influence of cycles of particular field treatments upon made tea.

### FACTORY RESEARCH.

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#### **Withering: Interim Report on Tests of Substitutes for Jute Hessian.**

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During 1935 a number of different wither materials have been tested against jute hessian. In each case a bank, or half a bank of tats has been equipped with the material under test. In every case hessian was alongside or stitched lengthwise to the new cloth, so that with a reversible withering system the relative positions in the loft of hessian and the material being tested were similar.

A large number of moisture contents were determined in a study of the rates of wither and, after withering, the leaf was manufactured separately alongside the control leaf from the hessian.

The results are tabulated below.

One control served for the comparison of wither linen, and the cotton cloth, while a separate control was used for scrim. With scrim new hessian was used since this material is made of jute hessian and tended to cause hessian taints while new.

### WITHER MATERIAL EXPERIMENTS.

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#### **A. Reports by Colombo Tasters (Average of 4).**

Tests I & II—Thin Spread—30 sq. ft. per pound Fresh Leaf

Tests III to VI Thick Spread—15 sq. ft. per pound Fresh Leaf.



## Note:—

|        |     |                                                                                |
|--------|-----|--------------------------------------------------------------------------------|
| J.H.   | ... | Jute Hessian.                                                                  |
| W.L.   | ... | Wither Linen (Open weave of linen cloth supplied by Messrs. Boustead Bros.)    |
| S.W.M. | ... | Cotton Cloth (Supplied by the Ceylon Spinning and Weaving Mills).              |
| SC.    | ... | Scrim (Open weave of hessian supplied by Messrs. Colombo Commercial Co., Ltd.) |

| Test No. | Date.   | Material.  | Valuation cts. |
|----------|---------|------------|----------------|
| I        | 2-8-35  | J.H.       | 70             |
|          |         | W.L.       | 70             |
|          |         | S.W.M.     | 69             |
|          |         | J.H. (New) | 70 (Hessian    |
|          |         | SC. (New)  | 67 Taint)      |
| II       | 7-8-35  | J.H.       | 70             |
|          |         | W.L.       | 71             |
|          |         | S.W.M.     | 67             |
|          |         | J.H.       | 70 (Hessian    |
|          |         | SC.        | 67½ Taint)     |
| III      | 14-8-35 | J.H.       | 70             |
|          |         | W.L.       | 71             |
|          |         | S.W.M.     | 68½            |
|          |         | J.H.       | 70 (Hessian    |
|          |         | SC.        | 68 Taint)      |
| IV       | 16-8-35 | J.H.       | 71             |
|          |         | W.L.       | 74             |
|          |         | S.W.M.     | 71             |
|          |         | J.H.       | 71½            |
|          |         | SC.        | 71             |
| V        | 21-8-35 | J.H.       | 71             |
|          |         | W.L.       | 69             |
|          |         | S.W.M.     | 69             |
|          |         | J.H.       | 70½            |
|          |         | SC.        | 67             |
| VI       | 22-8-35 | J.H.       | 70             |
|          |         | W.L.       | 69             |
|          |         | S.W.M.     | 71             |
|          |         | J.H.       | 70½            |
|          |         | SC.        | 72½            |

**Average of above.**

(Colombo Reports)

2-8-35—22-8-35.

| Material |     |     | Valuation cts. |
|----------|-----|-----|----------------|
| J.H.     | ... | ... | 70             |
| W.L.     | ... | ... | 71             |
| S.W.M.   | ... | ... | 69             |
| J.H.     | ... | ... | 70½            |
| SC.      | ... | ... | 69* (70½)      |

\* This average is reduced by the tainting due to new jute.

**1934 Tests — Colombo Reports.**

| Details.              |     | Material. | Valuation cts. |
|-----------------------|-----|-----------|----------------|
| Thin spread.          | ... | J.H.      | 69             |
| Bulk of seven series. | ... | W.L.      | 68             |
| 10-10-34—31-10-34.    |     |           |                |
| Thick spread.         | ... | J.H.      | 70             |
| Bulk of seven series. | ... | W.L.      | 71½            |
| 3-11-34—15-11-34.     |     |           |                |
| Average of above      | ... | J.H.      | 69½            |
| 10-10-34—15-11-34.    |     | W.L.      | 70             |

**Percentage Moisture Content of Withered Leaf.**

| Details.                                                        | Material | % Moisture. |
|-----------------------------------------------------------------|----------|-------------|
| Average percentage moisture in sample taken at centre of banks. | J.H.     | 57·1        |
|                                                                 | W.L.     | 56·2        |
|                                                                 | S.W.M.   | 57·2        |
|                                                                 | J.H.     | 57·6        |
|                                                                 | SC.      | 56·7        |
|                                                                 |          |             |
| Average percentage moisture in sample taken at end of banks.    | J.H.     | 57·1        |
|                                                                 | W.L.     | 55·5        |
|                                                                 | S.W.M.   | 57·1        |
|                                                                 | J.H.     | 57·6        |
|                                                                 | SC.      | 56·4        |
|                                                                 |          |             |

| Details                                                                | Material | % Moisture |
|------------------------------------------------------------------------|----------|------------|
| Average percentage<br>moisture in sample<br>taken from top tats.       | J.H.     | 60.1       |
|                                                                        | W.L.     | 56.0       |
|                                                                        | S.W.M.   | 58.8       |
|                                                                        | J.H.     | 59.3       |
|                                                                        | SC.      | 55.4       |
|                                                                        |          |            |
| Average percentage<br>moisture in sample<br>taken from middle<br>tats. | J.H.     | 58.0       |
|                                                                        | W.L.     | 58.2       |
|                                                                        | S.W.M.   | 57.6       |
|                                                                        | J.H.     | 58.3       |
|                                                                        | SC.      | 59.1       |
|                                                                        |          |            |
| Average percentage<br>moisture in sample<br>taken from bottom<br>tats. | J.H.     | 53.3       |
|                                                                        | W.L.     | 53.4       |
|                                                                        | S.W.M.   | 55.1       |
|                                                                        | J.H.     | 55.2       |
|                                                                        | SC.      | 55.3       |
|                                                                        |          |            |

**Percentage Moisture.**

| Details.                                                      | Material. | % Moisture. |
|---------------------------------------------------------------|-----------|-------------|
| Average percentage<br>moisture of 4 series<br>2-8-35—8-8-35.  | J.H.      | 57.0        |
|                                                               | W.L.      | 56.3        |
|                                                               | S.W.M.    | 56.4        |
| <i>Spread Thin</i> —30 sq. ft.<br>per pound.                  | J.H.      | 58.0        |
|                                                               | SC.       | 57.8        |
| Average percentage<br>moisture of 6 series<br>14-8-35—23-8-35 | J.H.      | 57.2        |
|                                                               | W.L.      | 55.5        |
|                                                               | S.W.M.    | 57.9        |
| <i>Spread Thick</i> —15 sq. ft.<br>per pound.                 | J.H.      | 57.2        |
|                                                               | SC.       | 55.8        |
| Average percentage<br>moisture of the 10<br>series.           | J.H.      | 57.1        |
|                                                               | W.L.      | 55.9        |
|                                                               | S.W.M.    | 57.1        |
| 2-8-35—23-8-35.                                               | J.H.      | 57.6        |
|                                                               | SC.       | 56.6        |

The results so far obtained indicate very little difference of practical significance. The open construction of material such as wither linen and scrim leads to a rather harder wither, the difference being accentuated with thick spreading.

In quality of the teas made on these various types of wither materials there is a very small difference, in most cases not concomitant with the difference in cost of the materials.

Wearing qualities are still an unknown factor, but with the materials of open construction there are signs of pulling and there is an element of doubt as to whether they will last as long as ordinary jute hessian.

Difficulty in removal of leaf after withering has not been experienced with any of the materials tested.

New scrim seemed to cause more marked taints than new ordinary hessian, and this must be considered when examining the average price realised by the teas withered on the various materials.

The tests with these materials are not yet completed. Samples of teas are being sent to London and further manufactures will be made at a later date.

The wearing properties will also be kept under observation.

**Rolling and Sifting:**—The experiments described below were of a preliminary nature and the results may therefore be modified in subsequent work.

After the installation of the motors and the kilowatt recorders a large amount of work was involved in the standardisation of the machinery and apparatus.

The kilowatt recorders were adjusted in order to obtain clear records, and the clocks set to the requisite speed. One of the clocks had to be taken down as the mechanism was jamming at certain intervals. These repairs were carried out in the Department.

At this stage the rollers were in identical pairs. The difference between the pairs was only slight from the point of view of technical efficiency, but the batten types were different, two being of the Reves type, and two of the Lamont-Michie type.

The following points were then investigated:—

1. Do two rollers identical in mechanical detail give similar results with bulked leaf, following a set rolling programme designed to work on spring compression measurements of pressure applied ?



The following results were obtained working to a spring compression of 1 cm. on the pressure gauges :—

#### Dhool Weight.

|         | <u>Roller 1</u> |      | <u>Roller 2</u> |      |
|---------|-----------------|------|-----------------|------|
|         | lbs.            | ozs. | lbs.            | ozs. |
| Dhool 1 | —               | 6    | —               | 6    |
| 2       | 3               | 8    | 2               | 6    |
| 3       | 4               | 5    | 3               | 0    |
| B.B.    | 20              | 13   | 23              | 5    |

These results were not satisfactory and in any case the calibration on the spring compression gauges were very difficult to follow.

As an alternative it was decided to work to equal power consumption as measured on the kilowatt recorders, adjusting the pressure applied in order to keep this reading steady. Results follow :—

#### Dhool Weight.

|         | <u>Roller 1</u> |      | <u>Roller 2</u> |      |
|---------|-----------------|------|-----------------|------|
|         | lbs.            | ozs. | lbs.            | ozs. |
| Dhool 1 | —               | 6    | —               | 5    |
| 2       | 3               | 4    | 3               | 0    |
| 3       | 4               | 12   | 4               | 8    |
| B.B.    | 20              | 11   | 21              | 6    |

At high pressure :—

|         |    |    |    |    |
|---------|----|----|----|----|
| Dhool 1 | —  | 11 | —  | 10 |
| 2       | 10 | 7  | 10 | 0  |
| 3       | 11 | 1  | 11 | 0  |

As a result of these experiments it was decided to discard springs, and work on dead weight applications for purposes of standardising roller pressures.

Two rollers have so far been converted, the weight of the caps having been adjusted to 60 lbs. each complete with pegs on to which three sets of weights of 50 lbs. each may be fixed.

A much more even performance is obtained accompanied by the great advantage of knowing exactly how many pounds pressure is being applied.

2. Preliminary investigations were made of the difference between the two types of battens using spring compression measurements of pressure.

|         | Lamont Michie |      | Reeves. |      |
|---------|---------------|------|---------|------|
|         | lbs.          | ozs. | lbs.    | ozs. |
| Dhool 1 | —             | 14   | 1       | 3    |
| 2       | 2             | 10   | 4       | 9    |
| 3       | 3             | 13   | 5       | 1    |
| Dhool 1 | —             | 5    | —       | 9    |
| 2       | 7             | 9    | 11      | 3    |
| 3       | 10            | 10   | 12      | 0    |

3. Effect of speed.—Rollers running at equal power consumption and different speeds.

In this case the batten types were identical and the rollers set at 50 r.p.m. and 76 r.p.m.

The pressures were so adjusted that the power consumptions were equal.

|         | 50 R.P.M. |      | 76 R.P.M. |      |
|---------|-----------|------|-----------|------|
|         | lbs.      | ozs. | lbs.      | ozs. |
| Dhool 1 | 2         | 9    | 1         | 14   |
| 2       | 7         | 6    | 4         | 7    |
| 3       | 7         | 0    | 4         | 6    |
| 4       | 7         | 14   | 3         | 2    |

This indicates that in a fast moving roller the work is wasted in ineffectual motion.

**Records:**—It soon became evident that criteria other than mere dhool out-turn must be applied to such experiments. Examinations of leaf after rolling were, therefore, undertaken in order to study the changes undergone during rolling. For this purpose permanent records were required and a method of leaf analysis and blue printing was evolved. Illustrations obtained by this method appear in *The Tea Quarterly* Vol. VIII, Part 4, December, 1935.

**Sifting:**—The studies mentioned above indicated that the buds and top portions of the first leaves tended to be twisted off before the coarser portions of the flush. There are indications that this state of affairs is influenced to a considerable extent by pressure.

Examination of the dhools obtained by means of the then existing roll breakers revealed that the constituents were of very mixed origin.

The question next arose as to whether it was worth while separating the grades of different origin and fermenting them separately. A preliminary experiment was carried out with this end in view.

Separation was done in the field, plucking a bud and one leaf separately from the second leaf. Some very fine teas, giving markedly even infusions, were obtained, which compared very favourably with a manufacture of normally gathered flush.

In order to further these findings and to enable an examination of the construction of dhools obtained in rolling experiments to be made by sifting, the roll-breakers have been altered, one to No. 5 mesh throughout, and the other No. 10 at the top (feed end) and No. 7 at the bottom. These are still not quite satisfactory, and it is proposed to reduce the amount of No. 10 mesh in relation to the amount of No. 7 mesh.

Trays are at the same time being fixed below the sieves in order to collect the dhools and deliver them into bowls. It is also intended to purchase suitable receptacles to collect bulk discharged from the roller and over the sifter so that the leaf will be kept off the floor.

**Fermenting:**—Fermentations have been carried out on aluminium sheets and galvanised iron with a view to examining the suitability of such materials as receptacles and vehicles for fermenting leaf. After a number of tests it has not been found possible to distinguish the teas made on these materials from those fermented in concrete.

Attempts to aerate fermenting leaf by carrying out the operation on a fine mesh or by periodically turning the dhools have so far met with failure, the tasters complaining of greenness compared with ordinary fermentation of leaf laid down on a concrete floor for the same length of time.

What undoubtedly happens is that the aerated leaf is cooled, the heat generated by fermentation being dissipated too rapidly, and fermentation is slowed down so that, compared with ordinary methods, the leaf is under-fermented when it goes to the firing machine. Longer periods of fermentation and warming of aerated leaf are being tried.

Provided that the correct amount of fermentation is carried out, thorough aeration of fermenting leaf should theoretically give a more even fermentation.

**Firing:**—For the purpose of carrying out firing experiments on a commercial scale one of the present hand-fed tilting tray type of machines is being replaced by an endless chain type of machine with automatic feeders and spreaders. Collectors for all the fired tea will be fitted, and sampling ports provided, so that the machine can be worked continuously without having to open up to remove any tea.

Specifications and drawings of a small-scale experimental dryer have been compiled and it is hoped that a local firm may undertake the construction.

The machine is designed as a wind tunnel, of uniform circular cross section throughout. In the heater section, steam heated gilled tube radiators will be placed, working at 35 lbs. pressure and capable of heating 500 cu. ft. per minute of air 140°F above normal intake temperatures, with 70 lbs. steam per hour. The fan will be capable of handling 720 cu. ft. per minute against 1.44 in. water gauge pressure, and will be driven by a 220-volt D.C. motor.

The drying chamber section will be traversed by six circular mesh trays of 2 feet 3 inches diameter and capable of carrying through 15 lbs. made tea per hour.

**Fuel Tests :—**A number of fuel tests have been carried out with firewood, coal, and liquid fuel. The method of the test has been to heat a fixed quantity of air to a temperature of 190°F, over a period of several hours, calculating the cost of heating up the dryer and the cost of fuel per hour for heating the air as above.

Results to date which are, however, of a preliminary nature and subject to revision show that firewood is the cheapest form of fuel, even with a comparatively inferior fuel at Rs. 3.00 per yard.

In these tests coal was an easy second. Liquid fuel was burned in an Allday Burner as installed with the dryer in St. Coombs factory.

Other types of oil burners will be investigated and it is hoped that the installation and tests of modern and more efficient oil burners will be supervised by experts of the Shell Co. of Ceylon, Ltd.

**Grading :—**Stamped metal sheet is being compared with brass weaving with a view to minimising greying of tea. It is hoped that a system of defining grades in terms of percentages passing through standard sieves may be worked out during 1936.

**Laboratory Investigations :—**The major part of the work coming under this heading has been dealt with under the heading "Analytical".

In addition to this, an investigation of the physical properties of tea in relation to the absorption of moisture was carried out. It was clearly demonstrated that the moisture in tea tends to establish an equilibrium with the moisture in the atmosphere with which it is in contact. This equilibrium is reversible and may result in either gain or loss of moisture by the tea. The permeability to water vapour of a number of different packing materials has also been examined. Full results are published in *The Tea Quarterly* Vol. VIII, Part 4.

An investigation of the rate of wither of leaf under fixed conditions of humidity and temperature has also been started. This apparatus consists of desiccators into which solutions of caustic soda of known vapour pressure may be placed.

The leaf is spread on mesh supported at some distance above the solution, and the air is stirred up by a small fan driven by a water-wheel attached to a laboratory tap in order that the wither may be carried on under the same conditions during the night.

The investigation was commenced by a study of the variations in different parts of the flush and in different pieces of flush from the same bush. This investigation is to be extended to a semi-commercial scale. Air conditioning in this case will be attempted by use of a refrigerator kindly presented by Messrs. Boustead Bros. through Mr. H. Crownshaw.

The methods for the estimation of Theotannin, as published by Shaw in Bulletins No. 4(a) and 4(b) of the Nelakota Experimental Station, South India are being examined with a view to applying them to following up the changes taking place in manufacturing experiments.

**Acknowledgments:**—In addition to the acknowledgment already made it is a great pleasure to record the help afforded by several engineers who have given much valuable advice and help. Of these, Mr. F. J. Whitehead deserves special mention, since most of the experiments on manufacture have benefited by his advice and constructive criticism.

J. LAMB,  
*Tea Technologist.*



# REPORT

OF

## THE SMALL-HOLDINGS OFFICER,

GAMPOLA, FOR 1935.

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**Meetings:**—Four meetings of small-holders were held during the period under review, two at Haris Pattuwa (Central Province) and two at Baddegama (Southern Province).

These meetings are organised for the purpose of advising small-holders as to how they can improve their holdings by planting green manures and the vigorous application of bulk and green manures to holdings.

The “Lock-and-Step” drain is advocated as the most economic method of draining that can be adopted, especially on small-holdings, with as good results as any other method.

The “Rim-Lung” prune is also advocated as the safest method of pruning that can be adopted by small-holders in contradiction to the “Cut-Across” or the “Clean Prune” which have both done more harm than good to the small-holders’ tea.

**Demonstration Work:**—These meetings help considerably in carrying out demonstration work. Meetings are followed up by visits to small-holders and inspections made of their holdings and demonstrations carried out. During these visits every possible assistance is rendered in the carrying out of the new methods. Small-holders are met individually when it is possible to make suggestions whereby one is able to overcome particular difficulties. At times it is possible to get a number of small-holders together and carry out demonstrations in the new methods of draining, pruning, etc. At these gatherings questions are asked whereby they learn more about their work. Individual visits and talks to small-holders have, I find, been the most effective method of convincing them of the correct thing.

**Villages Visited and Revisited:**—The work done during the year has been more or less centred in one Chief Headman’s Division, namely Uda-Palata. This of course was due to a competition organised among the small-holders in this division. Every village in Uda-Palata was visited

and revisited during this period when small-holders were met and careful instructions given as to the more improved methods of cultivation, draining and pruning as advocated by the Institute.

**Small-Holdings' Competition:**—Much has been said about this competition and its progress at various stages. As regards the competition itself, it was, I think, a great success — thanks to the very great keenness shown by the small-holders, who had to work under very difficult conditions, and the willing co-operation of the Headmen.

It was very disappointing not to have had our Chairman, Mr. James Forbes (Jnr.), Dr. R. V. Norris, the Director, and Mr. D. H. Kotalawala, all of whom have shown the greatest keenness in the small-holdings' work, present at our prize distribution owing to illness. We were glad to have Dr. C. H. Gadd who had always interested himself in the work of the small-holders to give away the prizes.

The prize distribution also proved a great success, there being a large number of small-holders present. In this connection I have to thank Messrs. C. D. Paul, J. Benzie and W. F. Stephen for helping us in the final judging.

The keenness shown by the small-holders at the last competition has led to the Institute voting more money for similar competitions and another competition has been organised in the adjoining Chief Headman's Division, namely Udu-Nuwara. Pamphlets have been issued and the competition has been well advertised among the small-holders of Udu-Nuwara.

A request was made to the four Village Committees of Uda-Palata for the necessary funds to organise another competition, but three of the Committees informed me of their inability to provide this (a sum of Rs. 50/-) while the Kandukara Ihala Korale Village Committee Chairman very kindly got his Committee to vote the necessary funds.

As it was not possible to organise a competition for one Korale I have had to postpone having a competition for Uda-Palata this year. I expect to make another appeal to the four Village Committees of Uda-Palata next year when I hope they will find it possible to vote the necessary funds.

**Malaria Epidemic:**—During the first three months of the year the epidemic was raging all over my area and it was found impossible to do any work and my services were lent for malaria relief work. The rains have helped considerably to improve the malaria situation in the villages but conditions are still not normal.

**Weather:**—The weather conditions that prevailed right throughout the year were most unfavourable for any agricultural purposes and the progress on small-holdings has been badly affected.

Tea crops were badly affected and if the small-holders had to depend mainly on this source of income for a livelihood, there would have been untold misery. Thanks to tea restriction, and coupons being saleable, small-holders were able to make ends meet and tide over their difficulties.

**The Divisional Agricultural Association:**—This Association still continues to function and a considerable amount of work is being done for the improvement of agricultural activities in the villages.

**Tea Restriction:**—Tea restriction was the one redeeming feature that saved the small-holders from starvation and death during the malaria epidemic. Tea coupons continue to be sold and this will only be stopped if legislation is introduced or the bought leaf factory owners can make it pay the small-holders to supply their leaf with coupons. During the latter part of the year there was a great demand for uncoupons leaf and a great number of small-holders brought their tea into bearing by adopting the "Cut-Across". A few were in time to reap the benefits of the prevailing good prices, but the majority of them found that when their fields came into bearing they were much too late to take advantage of the good prices. Their only satisfaction is that they will continue to pluck, hoping for better prices. There was a demand for this uncoupons leaf at four cents and five cents per pound but just now it is only two cents per pound. This rise in price was just after the August rains.

Just now about 60 per cent. of small-holders have brought their fields into bearing and maintain them in a fair condition. This has helped a number of bought leaf factories, which were idle at one time, to start work and give employment to many.

**Tea Coupons:**—There were three issues of tea coupons during the year and at every issue coupons were readily sold. On enquiries made I learnt that more coupons were sold as soon as they were received this year than any other year. The reason was sheer necessity due entirely to the malaria epidemic. The saleability of tea coupons have certainly helped the small-holder to tide over many of this difficulties, especially debt. Tea Restriction and saleability of tea coupons have in no way helped the bought leaf factory owners. The latter are to be sympathised with as they were a great source of help to the small-holders.

**Labour:**—The closing down of a number of bought leaf factories has meant a good deal of unemployment, especially among the Sinhalese men and women who have always found employment in these factories.

**General:**—The period under review has not been too favourable to the agriculturist. The prolonged drought and the malaria epidemic have been both responsible to a great extent for the very little progress made on small-holdings.

In conclusion, I would like to thank all those who have rendered me assistance and willing co-operation in my work, especially the Chief and Minor Headmen of Uda-Palata.

R. L. ILLANKOON,  
*Small-Holdings Officer, Gampola.*

# REPORT

OF

## THE SMALL-HOLDINGS OFFICER,

### BADDEGAMA, MARCH-DECEMBER, 1935.

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|                                         |     |     |                   |
|-----------------------------------------|-----|-----|-------------------|
| Small-Holdings Officer                  | ... | ... | E. F. Kannangara. |
| No. of small-holdings in Galle District | ... |     | 4,298             |
| Rainfall in Baddegama area for 1935     | ... |     | 118 inches        |
| ,, ,, ,, ,, ,, 1934                     | ... |     | 157.90 ,,         |

In submitting my Annual Report for the year ending December, 1935, I propose to give a brief survey of the work covered by me during this period. Having assumed duties at Baddegama on 24th March, 1935, *vide* my Half-Yearly Report submitted by me in July last, I concentrated my attention on educating the small-holder regarding the many benefits that would accrue to him by adopting the methods advocated by the Tea Research Institute of Ceylon.

I am pleased to mention here that my efforts in this direction have met with success. Those who were entirely indifferent as to the condition of their lands, but were only waiting for the date of the issue of coupons, have now realised that their actual asset is not the paper coupon, but depends on the condition of the land on which the tea is planted.

**Soil Erosion:**—I regret to mention that the question of soil erosion has not been given the proper consideration that is due to this grave problem. In up-country areas owing to the very steep nature of the land there has been no alternative but to adopt all resources to conserve the soil, but owing to the undulating and the semi-hilly condition of the land in this district there is an apathy on the part of the estate owner, particularly the small-holder, to make any efforts to prevent soil erosion. It is with some difficulty that I have made the small-holder understand the great value of top soil and the benefits he will derive by adopting the lock-and-step system of drains. I may mention here that I have brought nearly 500 acres of tea land under this system, most of which are in Gangaboda Pattu in Galle district.



**Rim-Lung Pruning:**—Originally there was little inclination on the part of the small-holders to take the trouble to adopt the rim-lung system of pruning. Having seen for themselves the demonstration plots along the roadside that were started since my coming, they are now gradually adopting this system of pruning. I am glad to mention here that 70 per cent. of the large estate owners and about 45 per cent. of the small-holders of Gangaboda Pattu are now adopting this system of pruning.

**Green Manure:**—The most popular green manure adopted by the small-holder is *Gliricidia*, the planting of which is gradually being continued owing to the supply being at hand. To convince the small-holder of the benefits deprived from green manures such as *Crotalaria*, *Dadap* (thornless), *Tephrosia vogelii*, etc., it is essential to make the above green manure easily available to him, either in the initial stages by free distribution from the Department of Agriculture, or on a nominal payment.

**Weeding and Cultivation:**—Since my assuming duties I have given particular attention to this part of the subject, as a result of which there is a vast improvement and there is hardly any small-holding which is badly neglected and unweeded.

**Supplying:**—Under the Tea Control Ordinance every tea nursery has to be registered. In the area that I look after there is a dearth of tea plants. In the earlier part of the year it was with difficulty that I convinced the small-holder that it was no offence to supply vacancies in his land; since then those who could obtain the plants have supplied the vacancies. There is, however, much to be done in this direction.

**Restriction and Prices:**—During the year under review the tea industry has gone through the third year of restriction. Generally restriction has brought beneficial results to the small-holders. During the latter half of the year Low-country tea prices continued to vary between 60 and 63 cts. Coupon prices varied from 29 to 31 cts. In this part of the district there is greater demand for bought leaf than last year and this has made the small-holder more enthusiastic to work their holdings and pay more attention to them.

**Visits to Morawak Korale:**—I reported myself to several estate owners, superintendents, and small-holders of Morawak Korale on the 19th, 20th, 21st and 22nd of November last. I explained to them the nature of my work and requested them to help me to improve the small-holdings in their District.

**SUMMARY.**

- (a). Attended three meetings of the Planters' Association of Southern Province.
- (b). Attended one meeting of the District Agricultural Committee of Galle.
- (c). Opened up 15 Demonstration Plots in different villages in Gangaboda Pattu.
- (d). Gave 52 demonstrations in Rim-Lung Pruning.
- (e). Gave 36 demonstrations in Lock-and-Step drains.
- (f). Delivered 11 lectures to small-holders.
- (g). Visited 54 villages where there are tea small-holdings.

E. F. KANNANGARA,  
*Small-Holdings Officer, Baddegama.*

# THE TEA RESEARCH INSTITUTE OF CEYLON.

## CAPITAL ACCOUNT AS AT 31ST DECEMBER, 1935.

| EXPENDITURE.                         |                 |                                           |                    | RECEIPTS.                                             |            |                                                      |                |
|--------------------------------------|-----------------|-------------------------------------------|--------------------|-------------------------------------------------------|------------|------------------------------------------------------|----------------|
|                                      | To<br>31-12-34. | Transferred<br>from Revenue<br>A/c. 1934. | Additions<br>1935. | Deduct cost of<br>Assets sold or<br>scrapped in 1935. | Total      |                                                      |                |
|                                      | Rs. Cts.        | Rs. Cts.                                  | Rs. Cts.           | Rs. Cts.                                              | Rs. Cts.   | Rs. Cts.                                             | Rs. Cts.       |
| <b>To LAND INCLUDING DEVELOPMENT</b> | 765,095-66      | —                                         | 23,156-76          | —                                                     | 788,252-42 | By GOVERNMENT OF CEYLON:—                            |                |
| BUILDINGS AND LINES                  | 845,584-60      | —                                         | 26,037-75          | —                                                     | 871,622-35 | Loan on Mortgage at 6% per annum                     | 1,000,000-00   |
| FURNITURE AND FIXED EQUIP-<br>MENT   | 60,657-49       | 7,554-05                                  | 5,485-95           | 202-19                                                | 73,495-30  | Less: Repayments to 31-12-34.                        | Rs. 127,138-15 |
| LABORATORY EQUIPMENT                 | —               | 33,487-69                                 | 1,806-26           | —                                                     | 35,293-95  | Repayments to 31-12-35.                              | 25,855-23      |
| EXPERIMENTAL MACHINERY               | 13,333-33       | —                                         | 7,336-28           | —                                                     | 20,669-61  | REVENUE APPLIED TO CAPITAL PURPOSES UP TO 31-12-35:— |                |
| MACHINERY (ESTATE)                   | 100,592-79      | Cr. 1,376-71                              | 734-85             | —                                                     | 99,950-93  | To 31st December, 1934                               | 874,992-34     |
| MOTOR CAR                            | 5,300-30        | —                                         | 4,269-00           | 5,300-30                                              | 4,269-00   | Revenue Account Surplus 1935                         | 53,314-91      |
|                                      |                 |                                           |                    |                                                       |            | Transfers between Capital and Revenue.               | 39,665-03      |
|                                      |                 |                                           |                    |                                                       |            | FUNDS OVERSPENT TO 31-12-35:—                        |                |
|                                      |                 |                                           |                    |                                                       |            | To 31st December, 1934.                              | 42,709-98      |
|                                      |                 |                                           |                    |                                                       |            | During 1935.                                         | 35,864-68      |
|                                      |                 |                                           |                    |                                                       |            |                                                      | 78,574-66      |
|                                      |                 |                                           |                    |                                                       |            |                                                      | 967,972-28     |
|                                      |                 |                                           |                    |                                                       |            |                                                      | 847,006-62     |

80

|                  |           |           |          |                  |
|------------------|-----------|-----------|----------|------------------|
| Rs. 1,790,564-17 | 39,665-03 | 68,826-85 | 5,502-49 | 1,893,553-56     |
|                  |           |           |          | Rs. 1,893,553-56 |

# THE TEA RESEARCH INSTITUTE OF CEYLON.

## GENERAL BALANCE AS AT 31ST DECEMBER, 1935.

| LIABILITIES                            |            | ASSETS.                                                                  |                       |
|----------------------------------------|------------|--------------------------------------------------------------------------|-----------------------|
|                                        | Rs. Cts.   |                                                                          | Rs. Cts.              |
| <b>CREDITORS :—</b>                    |            | <b>DEBTORS :—</b>                                                        |                       |
| Accrued Interest on Government Loan    | 12,705-09  | Controller of Finance and Supply                                         | ...                   |
| Sundries                               | 7,261-07   | Sundries :—                                                              | ...                   |
| Ceylon Association in London £11-10-1. | 153-77     | Jeremiah Lyon & Co., £26-12-8.                                           | 356-00                |
| <b>FURLOUGH RESERVE :—</b>             |            | Lindula Estate                                                           | 250-00                |
| At 31st December, 1934.                | 6,241-60   | Research Staff                                                           | 451-68                |
| Add : Reserve during 1935.             | 5,249-00   | Account Current, St. Coombs Estate                                       | 2,644-00              |
|                                        | 11,490-60  | Advertising A/c Sundry Debtors                                           | 552-50                |
|                                        |            |                                                                          | 4,254-18              |
| Deduct : Payments during 1935.         | 1,613-99   | ACCUED INTEREST ON FIXED DEPOSITS.                                       | ...                   |
| <b>DEPRECIATION RESERVE :—</b>         |            | STOCK-IN-TRADE                                                           | ...                   |
| At 31st December, 1934.                | 191,820-83 | CASH :—                                                                  | ...                   |
| Credited at 31st December, 1935.       | 34,122-98  | At Bank on Fixed Deposit                                                 | 111,860-61            |
|                                        | 225,943-81 | At Bank on Current Account                                               | 22,010-02             |
| Less : Loss on Car and Furniture       | 3,852-49   | In Hand                                                                  | 188-30                |
|                                        |            |                                                                          | 134,058-93            |
|                                        |            | <b>FUNDS OVERSPENT AT 31ST DECEMBER, 1934.</b>                           | 42,709-98             |
|                                        |            | CAPITAL EXPENDITURE 1935.                                                | 63,324-36             |
|                                        |            | REPAYMENT OF LOAN 1935.                                                  | 25,855-23             |
|                                        |            |                                                                          | 131,889-57            |
|                                        |            | <b>Less : REVENUE APPLIED FOR CAPITAL PURPOSES BEING REVENUE ACCOUNT</b> |                       |
|                                        |            | SURPLUS FOR THE YEAR                                                     | 53,314-91             |
|                                        |            |                                                                          | <b>Rs. 252,087-86</b> |

We have audited the books of the Institute kept by the Planters' Association at Kandy in which are incorporated the Estate Returns. We have not audited the Estate Accounts.

The allocations of Capital Expenditure and of Research Revenue Expenditure as made by the Director and sanctioned by the Chairman have been accepted by us.

We are not in a position to say whether the Reserves made for Depreciation are adequate.

Subject to the foregoing reservations, we certify that, to the best of our belief, the above Balance Sheet presents a true and correct view of the state of the Institute's affairs according to the information and explanations afforded to us and as shown by the books of the institute kept at Kandy.

(Sgd.) FORD, RHODES, THORNTON & Co.,  
Chartered Accountants.

Colombo, 11th March, 1936.

# THE TEA RESEARCH INSTITUTE OF CEYLON.

## ESTATE WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1935.

### EXPENDITURE.

|                               | Rs. | Cts.                  | INCOME.            | Rs.          | Cts.                  |
|-------------------------------|-----|-----------------------|--------------------|--------------|-----------------------|
| To ESTATE REVENUE EXPENDITURE | ... | 71,111-89             | By TEA SALES—LOCAL | 137,073 lbs. | 112,998-08            |
| ” CHARGES—EXPORT DUTY, ETC.   | ... | 6,312-57              | Do —FACTORY        | 1,109 ”      | 872-42                |
| ” BALANCE CARRIED FORWARD     | ... | 36,675-65             | Do —INFERIOR       | 1,525 ”      | 229-61                |
|                               |     | <u>Rs. 114,100-11</u> |                    |              | <u>Rs. 114,100-11</u> |

## REVENUE ACCOUNT AS AT 31st DECEMBER, 1935.

|                                   | Rs.      | Cts.             |                                        | Rs. | Cts. |
|-----------------------------------|----------|------------------|----------------------------------------|-----|------|
| To ADMINISTRATION OF THE BOARD :— |          |                  | By BALANCE FROM ESTATE WORKING ACCOUNT | ... | ...  |
| Planters' Association of Ceylon   | 4,800-00 |                  | ” TEA CESS                             | ... | ...  |
| Travelling Expenses of the Board  | 5,209-89 |                  | ” INTEREST                             | ... | ...  |
| Postages                          | 279-75   |                  | ” RENT OF CADDY                        | ... | ...  |
| Stationery                        | 742-32   |                  | ” MISCELLANEOUS RECEIPTS               | ... | ...  |
| Advertising                       | 125-75   |                  |                                        |     |      |
| Telephone Trunk Calls, etc.       | 134-98   |                  |                                        |     |      |
| Printing                          | 230-50   |                  |                                        |     |      |
| Legal Charges                     | 28-00    |                  |                                        |     |      |
| Auditors' Fees & Expenses         | 672-91   |                  |                                        |     |      |
| Contingencies                     | 169-32   |                  |                                        |     |      |
| Chairman's Clerk's Gratuity       | 150-00   |                  |                                        |     |      |
|                                   |          | <u>12,543-42</u> |                                        |     |      |

### PERSONAL EMOLUMENTS OF SCIENTIFIC STAFF :—

|                      |                  |
|----------------------|------------------|
| Director             | 22,500-00        |
| Mycologist           | 18,715-32        |
| Agricultural Chemist | 16,270-96        |
| Tea Technologist     | 8,030-36         |
| Entomologist         | 14,494-24        |
| Plant Physiologist   | 12,054-04        |
| Superintendent       | 2,525-00         |
|                      | <u>94,589-92</u> |

Carried Forward :—

Rs. 107,133-34

Carried Forward :—

Rs. 338,350-99



# THE TEA RESEARCH INSTITUTE OF CEYLON.

## REVENUE ACCOUNT AS AT 31ST DECEMBER, 1935.—(Contd.)

Rs. 338,350-99

Brought Forward :—

Rs. Cts.

Brought Forward :—

To EMOLUMENTS—JUNIOR & SUB. SCIENTIFIC STAFF :—

Junior Scientific Staff ... 24,133-67

Lab. Attendants and Fieldmen ... 3,477-00

LABORATORY :—

Equipment and General Working

Expenses ... 6,895-85

Furniture ... 249-84

LIBRARY AND PUBLICATIONS :—

Library ... 1,618-37

Publications ... Cr. 357-74

SMALL-HOLDINGS :—

Salaries and House Allowances

Travelling and General Expenditure ... 5,187-00

... 2,271-04

FIELD & FACTORY EXPERIMENTS :—

Agricultural Chemist ... 2,181-04

Plant Physiologist ... 2,435-55

Factory Experiments ... 1,787-92

LABORATORY OFFICES :—

Clerks' Salaries ... 3,880-80

Office Peon ... 492-00

Stationery and Equipment ... 1,338-46

Postages ... 518-81

Telegrams and Trunk Calls ... 207-68

Telephone Operators' Salaries ... 816-00

Carried Forward :—

Rs. 164,266-63

Carried Forward :—

Rs. 338,350-99

# THE TEA RESEARCH INSTITUTE OF CEYLON.

## REVENUE ACCOUNT AS AT 31ST DECEMBER, 1935.—(Contd.)

|                                                 | Rs.      | Cts. | Rs. | Cts. | Brought Forward :— | Rs.            | 338,350-99     |
|-------------------------------------------------|----------|------|-----|------|--------------------|----------------|----------------|
| To TRAVELLING OF STAFF :—                       |          |      |     |      |                    |                |                |
| Officers' Expenses ...                          | 4,533-59 |      |     |      |                    |                |                |
| Insurance of Car ...                            | 218-86   |      |     |      |                    |                |                |
| Driver's Wages ...                              | 1,082-74 |      |     |      |                    |                |                |
| Driver's Batta ...                              | 293-70   |      |     |      |                    |                |                |
| Running Expenses ...                            | 1,654-54 |      |     |      |                    |                |                |
|                                                 |          |      |     |      | 164,266-63         |                |                |
| „ MAINTENANCE OF BUILDINGS :—                   |          |      |     |      |                    |                |                |
| Laboratory ...                                  | 302-37   |      |     |      |                    |                |                |
| Six Senior Staff Bungalows ...                  | 560-88   |      |     |      |                    |                |                |
| Eleven Junior Staff Bungalows                   | 1,156-78 |      |     |      |                    |                |                |
| Clerks' Bungalows ...                           | 133-14   |      |     |      |                    |                |                |
| Miscellaneous Lines & Buildings                 | 503-87   |      |     |      |                    |                |                |
|                                                 |          |      |     |      | 2,657-04           |                |                |
| „ MISCELLANEOUS ITEMS SHARED WITH ESTATE :—     |          |      |     |      |                    |                |                |
| Electric Power ...                              | 3,990-64 |      |     |      |                    |                |                |
| Engine Room Staff ...                           | 691-45   |      |     |      |                    |                |                |
| Mechanic ...                                    | 559-25   |      |     |      |                    |                |                |
| Telephones, Rent and Maintenance of Lines ...   | 373-50   |      |     |      |                    |                |                |
| Roads ...                                       | 2,246-37 |      |     |      |                    |                |                |
| Sanitation ...                                  | 1,013-41 |      |     |      |                    |                |                |
| Superintendent's Furlough and Passage Allowance | 589-00   |      |     |      |                    |                |                |
| Tappal Lorry and Book Fees                      | 234-00   |      |     |      |                    |                |                |
|                                                 |          |      |     |      | 9,697-62           |                |                |
| „ UPKEEP OF GROUNDS :—                          |          |      |     |      |                    |                |                |
| Garden Cooly ...                                | 10-91    |      |     |      |                    |                |                |
| Labour and General Expenses                     | 1,174-97 |      |     |      |                    |                |                |
|                                                 |          |      |     |      | 1,185-88           |                |                |
| Carried Forward :—                              |          |      |     |      |                    | Rs. 185,590-60 |                |
|                                                 |          |      |     |      |                    |                | Rs. 338,350-99 |

THE TEA RESEARCH INSTITUTE OF CEYLON.

## REVENUE ACCOUNT AS AT 31ST DECEMBER, 1935.—(Contd.)

|                                                     | Rs.       | Cts. |                    | Rs.            | Cts. |
|-----------------------------------------------------|-----------|------|--------------------|----------------|------|
| To CONTINGENCIES :—                                 |           |      | Brought Forward :— | Rs.            | Cts. |
| Incidentals                                         | 120-37    |      |                    | 185,590-60     |      |
| Provident Fund Senior Scientific Staff              | 4,729-14  |      |                    |                |      |
| Do Junior do                                        | 1,893-81  |      |                    |                |      |
| Do Sub-Staff                                        | 465-09    |      |                    |                |      |
| Passages                                            | 2,300-00  |      |                    |                |      |
| Ceylon Nursing Association and Fraser Nursing Home. | 140-00    |      |                    |                |      |
| Medical Fees, Sub-Staff                             | 36-70     |      |                    |                |      |
| Medical Scheme, Junior Staff                        | 804-00    |      |                    |                |      |
| Insurances                                          | 2,895-26  |      |                    |                |      |
| Conference Expenses                                 | 258-10    |      |                    |                |      |
| Caretakers and Watchmen                             | 196-10    |      |                    | 13,338-57      |      |
|                                                     |           |      |                    |                |      |
| GOVERNMENT OF CEYLON LOAN INTEREST ACCOUNT.         | 51,983-93 |      |                    |                |      |
| DEPRECIATION ACCOUNT.                               | 34,122-98 |      |                    |                |      |
| BALANCE                                             | 53,314-91 |      |                    |                |      |
|                                                     |           |      |                    |                |      |
|                                                     |           |      |                    | Rs. 338,350-99 |      |

## LOAN ACCOUNT

| To GOVERNMENT OF CEYLON | ... | ... Rs. 1,000,000-00 | By REPAYMENTS :—    | Rs. Cts.  | Rs. Cts.         |
|-------------------------|-----|----------------------|---------------------|-----------|------------------|
|                         |     |                      | 1st Instalment 1929 | 18,227-00 |                  |
|                         |     |                      | 2nd " 1930          | 19,320-72 |                  |
|                         |     |                      | 3rd " 1931          | 20,479-00 |                  |
|                         |     |                      | 4th " 1932          | 21,708-60 |                  |
|                         |     |                      | 5th " 1933          | 23,011-09 |                  |
|                         |     |                      | 6th " 1934          | 24,391-74 |                  |
|                         |     |                      | 7th " 1935          | 25,855-23 | 152,993-38       |
|                         |     |                      | „ Balance Due       | ...       | 847,006-62       |
|                         |     |                      |                     |           | Rs. 1,000,000-00 |
|                         |     |                      |                     |           | Rs. 1,000,000-00 |













